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"The High Authority"

It was in April, 1951, that the "High Authority" was formed to create a "European Community for Coal and Steel." We cordially dislike this phrase "High Authority"—regarding it as a pretty poor translation of the French title. It needs anglicizing and some such wording as the "European Iron and Steel Control Board" would conform better with English nomenclature. The "Authority" started operation early last year and immediately made history by opening the frontiers of Belgium, France, Holland, Germany and Luxembourg for the free passage of coal, iron ore, iron and steel. As a result of its operations and in spite of a falling demand, there has been an increase in international business. Prices have fallen, but it is maintained that production has been at a higher rate than would otherwise have been the case. Steel prices were freed from Governmental control and any attempt to form price cartels was frowned upon. There is a duty imposed on all producers to issue a price list, but in addition to understandable delays, these documents did not invariably represent the amounts invoiced, and discriminations rapidly developed and "preserved" territories were in vogue. Now, the rule has been changed, for it was on January 7 enacted that if on an examination of 60 days' trading the price list is not within 2½ per cent. of the invoiced price, then it must be adjusted to enter within this margin. Delinquents can be fined by twice the amounts of their resulting gains for the first offence and double that figure for the second.

The executive is composed of nine individuals drawn from the participating countries, but they are not representatives of either their governments or their industries. There is in addition a Consultative Committee of 51 members and an Assembly of 78 members elected by the national parliaments, capable of dissolving the Authority by a "no confidence" vote. A court of justice and a Council of Ministers complete the organization, and somewhere within it, there are delegations from outside countries, which include Great Britain and America.

It is well known that the British are to be invited to join the High Authority in the near future and what the effect of full participation in this body would be is difficult to envisage. At the moment, British prices are competitive for iron and steel products. Politically it can be regarded as a step towards a United Europe. The situation is not without interest to readers as an organization now exists which co-ordinates the activities of the principal European foundry employers' associations. International business in castings—as castings—is not high amongst European countries; most exports are overseas, and, with the exception of cast-iron pipes, these are of no serious proportions. Yet it must be borne in mind, that British ferrous foundry interests are integrated with the iron and steel industry since the passing of the Act governing the freeing of the latter from public ownership. We are expressing no definite views on the implications arising from this "High Authority," as conversations with numerous foundry executives revealed that few were aware of its existence.

F

I.B.F. Jubilee Meeting and Banquet

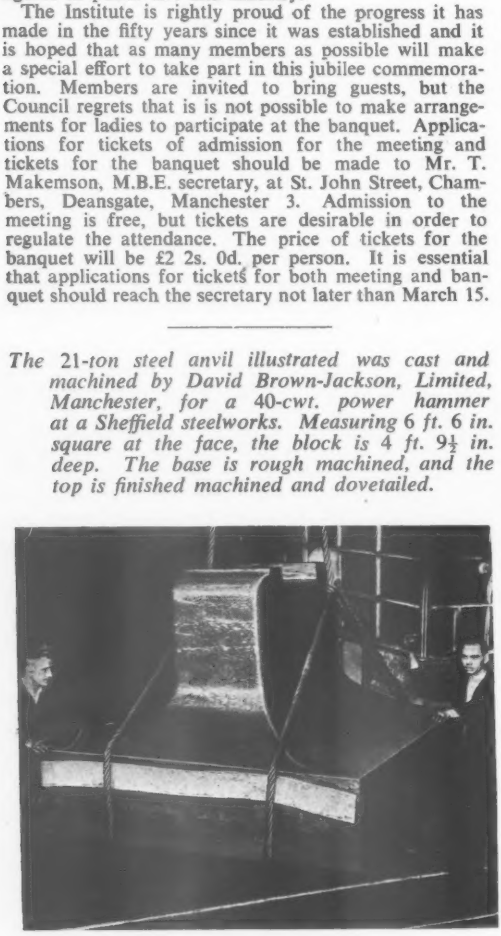
To commemorate the golden jubilee of the founding of the Institute of British Foundrymen, the Council has arranged for a special meeting and banquet, both to be held on the fiftieth anniversary of the Institute's birth, namely Friday, April 9, 1954.

At 2.30 p.m. at the Cafe Royal, Regent Street, London, W.1, there will be presented the Jubilee Lecture: "Development of the Foundry Industry during the past Fifty Years," by V. C. Faulkner and S. H. Russell, both past-presidents. At this meeting also it is intended to present the jubilee award to the junior member who has submitted the entry adjudged to be the best in the short-paper competition which the Council has organized as part of the celebrations.

At 7 for 7.30 p.m., the Jubilee Banquet will take place, also in the Cafe Royal, Regent Street, London, W.1, and it is hoped that the occasion will be honoured by the presence of a number of prominent figures in public life and industry.

The Institute is rightly proud of the progress it has made in the fifty years since it was established and it is hoped that as many members as possible will make a special effort to take part in this jubilee commemoration. Members are invited to bring guests, but the Council regrets that is is not possible to make arrangements for ladies to participate at the banquet. Applications for tickets of admission for the meeting and tickets for the banquet should be made to Mr. T. Makemson, M.B.E. secretary, at St. John Street, Chambers, Deansgate, Manchester 3. Admission to the meeting is free, but tickets are desirable in order to regulate the attendance. The price of tickets for the banquet will be £2 2s. 0d. per person. It is essential that applications for tickets for both meeting and banquet should reach the secretary not later than March 15.

The 21-ton steel anvil illustrated was cast and machined by David Brown-Jackson, Limited, Manchester, for a 40-cwt. power hammer at a Sheffield steelworks. Measuring 6 ft. 6 in. square at the face, the block is 4 ft. 9½ in. deep. The base is rough machined, and the top is finished machined and dovetailed.



Newton Chambers' Board Changes

The appointment of three assistant managing directors, each with special responsibilities, is among administrative changes announced by Newton Chambers & Company, Limited, Thorncliffe, founders, gas, chemical and general engineers, near Sheffield. The assistant managing directors are Mr. S. C. Tyrrell (excavator branch), Mr. K. E. Walker (engineering branch, including the heavy constructional department and the light-castings department), and Mr. P. J. C. Bovill (chemicals branch). The company is also strengthening its London organization by giving Mr. R. F. A. Sampson, a local director, special responsibility for London interests. It is also announced that Sir Harold West, the managing director, has been appointed vice-chairman of the company, an appointment which will not affect his duties and responsibilities as managing director.

For each of the three production branches, there will be a committee of management, consisting of the managing director as chairman, the appropriate assistant managing director as vice-chairman, the appropriate general manager, and the London local director. The services department committee of management will consist of the managing director, the three assistant managing directors, and the general manager. The Board of local directors of the company will continue to act in an advisory capacity to the managing director.

The company points out that one important effect of the reorganization will be to enable the managing director to delegate his personal responsibility to the extent that his span of control will be through fewer senior executives. The managing director will thus be enabled to devote special attention to overall control of production policy, to the administrative problems of the firm's interests in associated companies, and to direction of certain headquarters departments whose activities contribute to the progress and well-being of the company as a whole.

"Chartered Mechanical Engineer"

This is a new and delightful publication issued by the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. It replaces the former *Journal* and is to be issued monthly, except in July and August. In it there are all the forthcoming events connected with the Institution, the names and addresses of all the branch secretaries, and similar useful and essential information, together with lengthy abstracts of the papers presented to the parent body. Any of the forty thousand members interested in any particular paper will be furnished with a preprint. The *Proceedings* will be available in the form of a bound volume to members at a reasonable charge. The new system is an enlightened one and realistic in that it envisages that but few people need to conserve printed matter dealing with every phase of mechanical engineering, but many do value an unadulterated collection of matter covering their special interests.

Luncheon

BRITISH INDUSTRIAL MEASURING AND CONTROL APPARATUS MANUFACTURERS' ASSOCIATION

Mr. H. W. Blake, the president, was in the chair at the Association's annual luncheon. At the high table were Mr. W. G. Thomas; Col. Sir Harold Smith, K.B.E., D.L.; Mr. Douglas Wilson; Mr. W. G. Ardley; Mr. Wm. C. Knell; Mr. H. W. Arkell; and Miss H. V. Lupton.

Rational Foundry Management*

By F. Buckley, B.Sc., F.I.M.

The subject matter of this Paper is practically identical with that given a year ago in connection with the British Cast Iron Research Association's conference at Ashorne Hill on "Economy in the Foundry."† Then as now the Author selected as a guide a portion of the excellent address which Dr. Dadswell, the former president of the Institute, gave at his initiation. This was as follows:—"Do not let us hear any more 'Well, of course, we are a jobbing foundry' in the manner which indicates that there is nothing that can be done. The jobbing foundry is the most interesting of all. Logical thought, and—do not be frightened of the words—'scientific management' can be applied and should be applied to it just as much as any other foundry." The Author believes it is also necessary to mention that the experiences now recounted are personal ones gained over the period approximately 1945 to 1949 and apply to the very difficult post-war years when shortage of generating plant was an acute national emergency. The modifications described were prefaced by five months' training in the United States when valuable opportunities were afforded of studying and actually working in American foundries. It is felt, therefore, that the experience gained, both here and in America in promoting the increased productivity of a typical jobbing foundry attached to an engineering works, provides a good discussion ground for the subject of rational foundry management.

It is proposed to treat this subject on a broad basis, since it is felt a danger exists in examining too narrowly the problems involved in increased productivity in this type of foundry. It is inadvisable, for example, to study minor savings in sand practice and composition if the whole conception is wrong. It is folly to seek minor economies unless the major production problems have first been solved.

Taking a particular case, the English Electric Company operates two large foundries producing iron castings: a large mechanized plant devoted to domestic and light industrial castings for such purposes as electric-motor frames, etc., and a heavy jobbing foundry supplying the needs of large prime-mover factories, the latter ranging from the fairly-high-speed Diesel engines, such as are used for powering Diesel-electric locomotives to the largest turbo-alternators (Figs. 1 and 2). It will be readily appreciated that the variety of castings may range from a few pounds to 30 tons in weight, and that the "numbers off," particularly for the larger type of component, will necessarily be very limited.

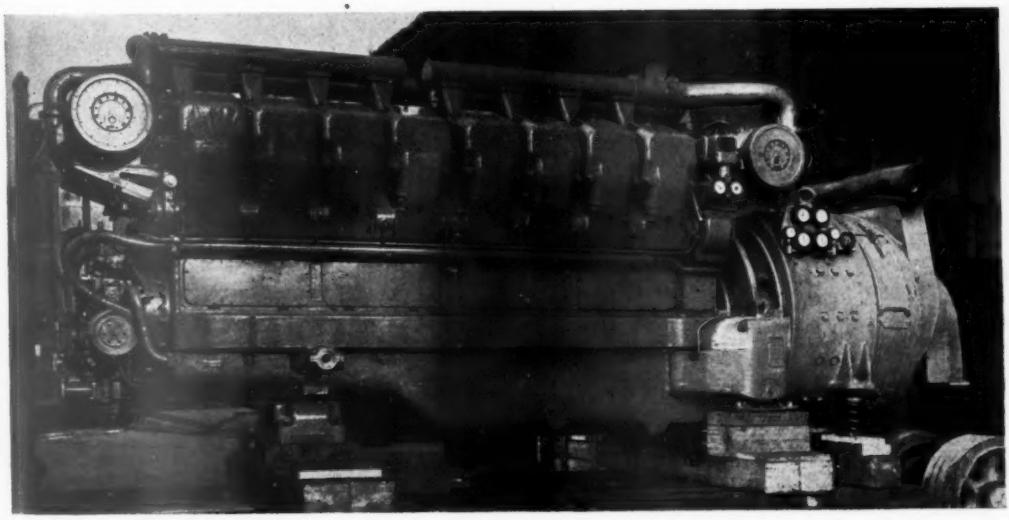
*Paper presented to the Scottish branch of the Institute of British Foundrymen, Mr. John Cameron, Jnr., presiding.

† Briefly reported in the JOURNAL, December 4, 1952, p. 653.

Changes Envisaged

It is not proposed to deal with the company's mechanized foundry, except to say that this also has undergone a particularly large-scale and successful expansion on fairly conventional lines. However, it is felt that the jobbing foundry may provide a

FIG. 1.—*Large Diesel-electric unit typical of the manufactures of English Electric Company Limited for which castings in the medium-weight range are required.*



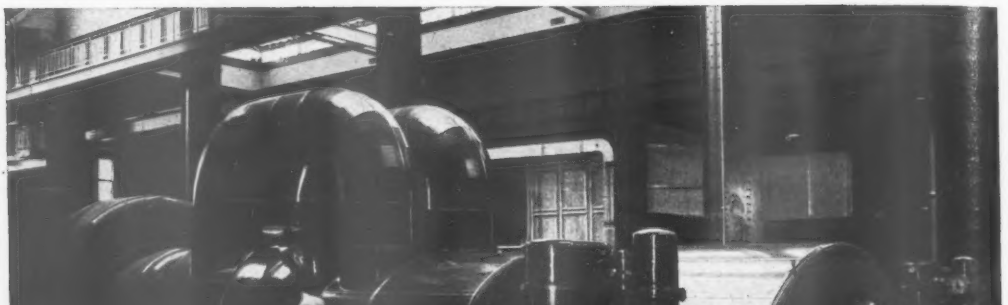
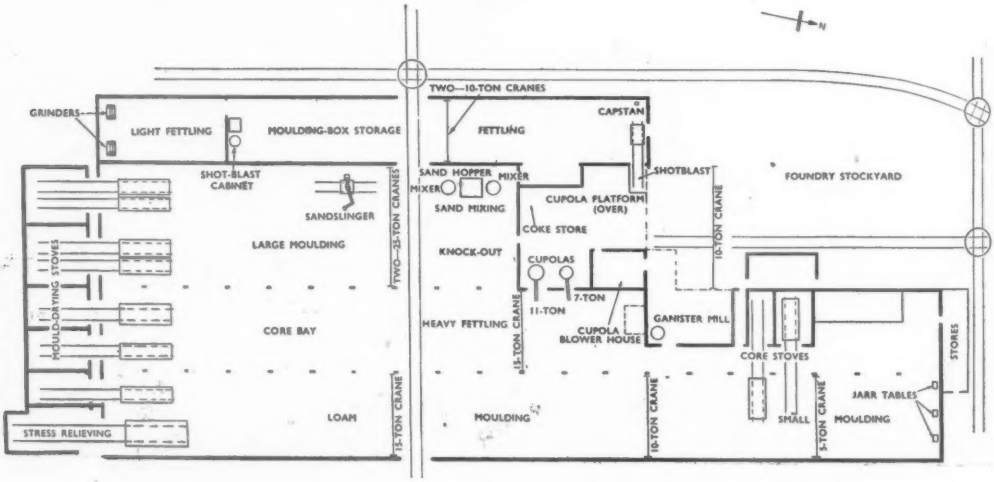


FIG. 2.—*Power-station turbo-alternator plant in which some of the largest castings manufactured by E.E.C. are incor porated.*

stimulating and thought-provoking example, since it is typical of the bulk of foundries in this country attached to engineering works and acting as a feeder department to the main works production. As a result of expansion to the main works and ancillaries, an increase of at least × 2½ was required in castings production, and the following summarizes the problems existing at the time of the contemplated development:

(1) Castings provide the first link in the chain of production and an early increase in production rate was vital.
(2) For this reason it was necessary to keep expansion of buildings and floor facilities to an absolute minimum.
(3) Little or no increase in labour force, particularly of the skilled manpower, would be possible.

FIG. 3.—*Layout of English Electric Company's Rugb y Foundry prior to the introduction of mechanized systems.*



The foundry was producing from 35 to 50 tons of castings per week, ranging from ½-lb. to 30 tons, all of which were made by hand, in green-sand, dry-sand and loam, each section working independently and utilizing separate sand plants, the lay-out of the foundry at this time being approximately as shown in Fig. 3. Broadly speaking, the foundry was divided up into a small moulding unit with its own core-shop (A), this section operating independently. The larger type of work was divided into large sand moulding (in which case a limited amount of impeller ramming was possible, utilizing a stationary machine) and loam moulding, mostly carried out in pits which are not shown. The loam-moulding bay had its own loam-preparation plant, which consisted of a pug mill. The fettling area (B), was not capable of taking the heavier class of castings, which had thus to be finished off in the main foundry in the space marked (C). The core bay was located between the large-moulding and loam-moulding areas, feeding directly into these areas. To produce at least three times as much in the same area, therefor, demanded drastic, almost revolutionary, steps and the principal changes in lay-out resulting from the reorganization are shown in Fig. 4. The main change from the previous lay-out is that the core-making has been concentrated into one area, both large and small work being produced mechanically. A separate building has been constructed to house a Hydroblast plant and to enable the largest castings to be fettled in a location sufficiently removed from the foundry. The area vacated has been made into a moulding-box and pattern-preparation department for the medium and heavy work. In each case, the lay-out facilitates the adoption of a logical sequence

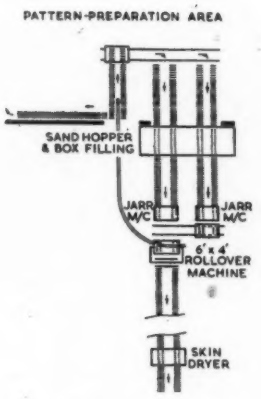


FIG. 5.—*Plan view of the layout of the ramming and stripping station for medium-size castings.*

of operations for the production of moulds, casting processes and knocking-out operations.

Modifications to Production Techniques

(1) *Moulding Practice.*

It is obvious that the available skilled labour would have to be concentrated on the essential operations of finishing and closing, the semi-skilled and unskilled labour being allocated to mould preparation and ramming operations. It was decided, therefore, to manufacture all moulds, irrespective

FIG. 4.—*Revised layout of the E.E.C. foundry at Rugby consequent upon the adoption of mechanized processes.*

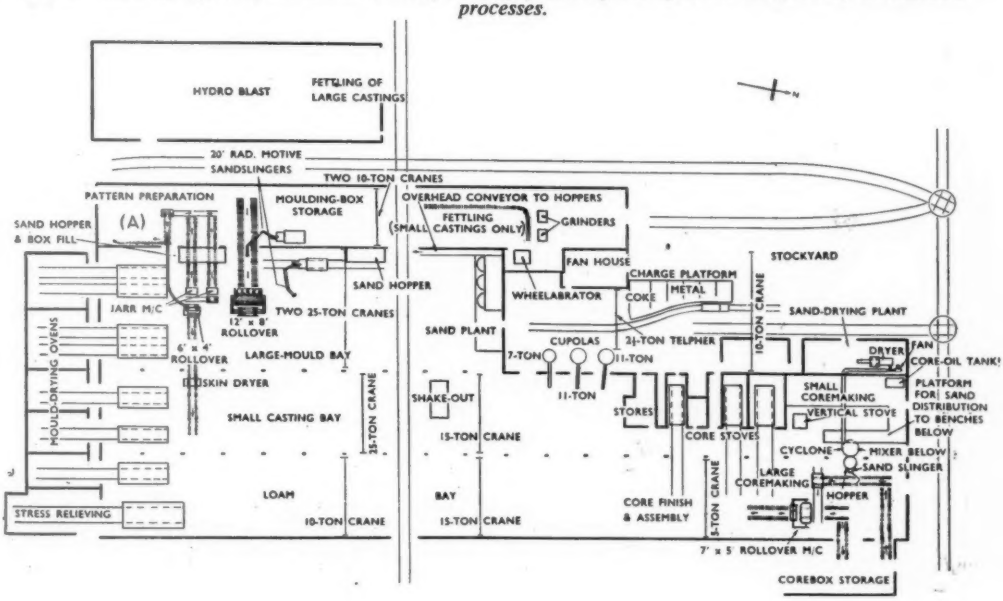
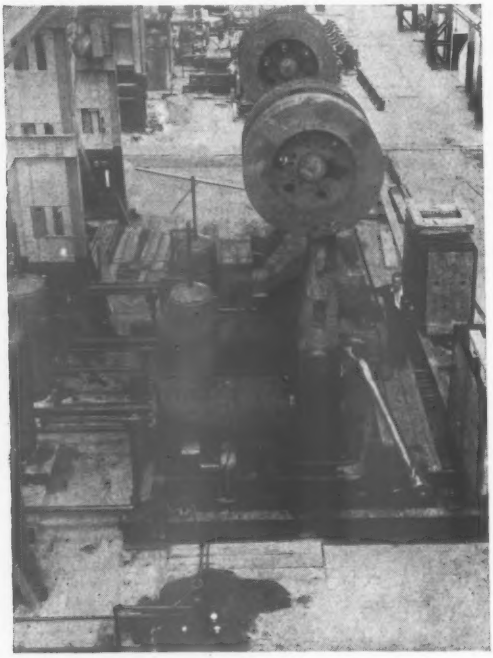


FIG. 6.—*General impression of the ramming and stripping station shown in Fig. 5; note the use of comparatively shallow box parts.*

FIG. 7.—*Final test of the roll-over. pattern-draw moulding machine (capacity 24,000 lb.), in which two flywheels were bolted to each arm (total 16 tons) and elevated.*



of size, on machines, with the exception of the largest castings and certain classes of loam work.

(*a*) *Small castings.*

The manufacture of the smallest castings was largely diverted to the alternative foundry of the Group, but a small number are still manufactured on small jolt-squeeze machines in green-sand by conventional methods.

(*b*) *Medium castings.*

Medium castings (up to about 30 cwt. in weight and with a box limit of 6 by 4 ft.) are manufactured on well-known jolt-roll-over machines of 4,000-lb. capacity. These depart from the conventional set-up in that the basic operations are split up into line production.

On account of the wide variety of the work a large preparation area is necessary and this is shown in Fig. 4 at A leading to the ramming and stripping station shown in Fig. 5. A number of jigs, up to about ten in number, and fabricated of wood and metal, can be circulated around the system, and the patterns, mounted on plywood bases, are dropped into these. The moulding box is next placed on the jig, located on box pins, and the assembly is pushed to the sand filling station (Figs. 5 and 6). After filling, the box is rolled to the jolt position, the rollers are retracted, and the requisite number of jolts are applied. The rollers are elevated, the box is pushed to the roll-over position, pattern is stripped, and both jig and pattern are returned to the starting line. If more than one casting is required, the jig is allowed to pass through the system again or, alternatively, the pattern is removed and a new one is substituted. Each jig follows closely on the preceding one and a high effective rate of operations is obtained. The total personnel operating

the system to the roll-over station is four. One operator carries out the pattern changes and applies the boxes, another does the sand filling, a third operates the jolt procedure, while the fourth carries out the roll-over and pattern-return operations. In addition, wide variations of patterns and boxes can be produced simultaneously and no skilled labour is required to handle the moulds until the finishing operation, which is followed by skin drying. The system allows the production of one or twenty moulds off a given pattern with equal facility and it is possible to standardize on six sizes of moulding box.

(*c*) *Medium/large castings.*

It was decided to produce moulds up to a box size of 13 by 8 ft. by utilizing impeller rammers in conjunction with a roll-over-and-pattern-draw machine. The latter machine was designed by Pneulec Limited, and because of the size, its production and manufacture was a joint effort by the two companies. The machine has a pattern draw of approximately 48 in., the maximum load being 24,000 lb. Here again, the design was arranged to give the utmost flexibility in box sizes, although it was possible to standardize on no more than seven or eight. The main components of the machine, including the arms, were cast in a high-duty cast iron of 28 tons tensile srtength and these presented quite a problem in manufacture from the point of view of retaining soundness in the sections involved. Fig. 7 illustrates the final tests being carried out on the machine, two fly-wheels being bolted to each arm and elevated—a total test weight of 16 tons. Figs. 8-11 illustrate the actual roll-over operation.

Fig. 12 is an example of the results obtained with this set-up, and shows a crankcase from a Diesel engine weighing over two tons, the dimensions being 8 ft. 6 in. by 3 ft. 6 in. by 3 ft., which is cast within 30 hours of starting the ramming-up operations, this period of course including the overnight drying period.

Two mobile impeller ramming machines are used to feed moulds to the machine and here again the preparation work is of major importance, patterns

FIGS. 8 TO 11.—*Stages in the operation of the Pneulec/E.E.C. roll-over, pattern-draw moulding machines. A box size up to* 13 *by* 8 *ft. and* 48*-in. draw is catered for.*

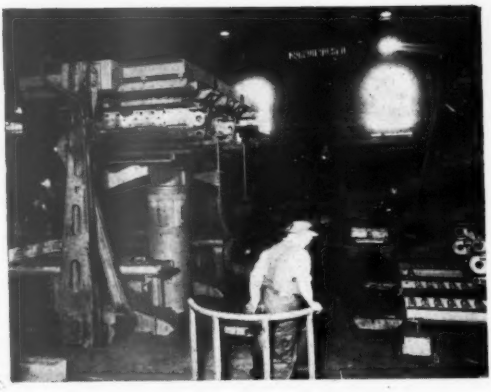


FIG. 12.—*Example of castings produced on the impeller-rammer, roll-over, pattern-draw set up—a Diesel-engine crankcase poured within 30 hours of commencement of moulding (including the overnight drying period).*

being mounted on jigs and rammed-up on the roller track communicating with the roll-over table.

(*d*) *Heavy castings.*

Heavy work, including quite a large percentage of jobs formerly cast in pits is now produced by box moulding, utilizing impeller rammers, and in addition a patented technique of moulding, which has been called "sectional moulding," has been developed. This is widely adaptable to large castings

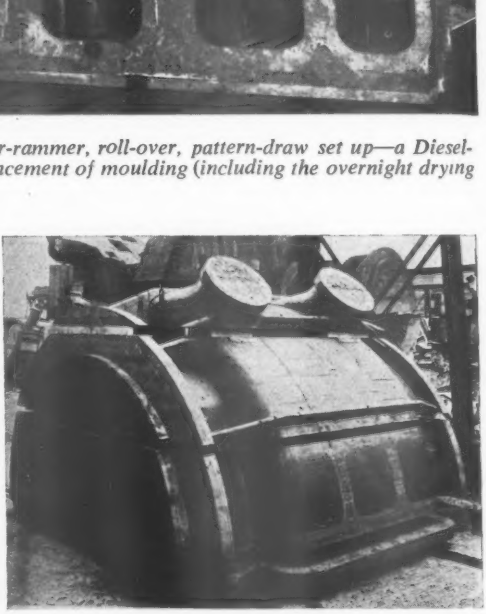


FIG. 13.—(*below*) *Turbo-alternator casing, weighing over 12 tons, an example of the heavy castings produced by the patented technique at E.E.C.*

FIG. 14.—(*top right*) *Pattern for the turbo-alternator casing spaced to show the "slices" into which it is divided for moulding.*

FIG. 15.—*Cores being placed in the turbo-alternator casing mould.*

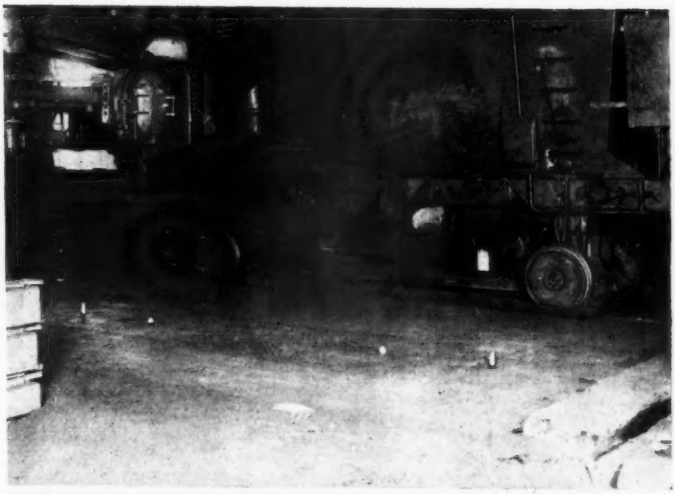
between 5 and 20 tons in weight, and consists simply of slicing up the pattern into convenient, and wherever possible, standard thicknesses. Following this method, the bottom part of the mould is rammed and dried and the coring-up operations are in progress before the remaining mould sections have been finish rammed (Figs. 13 to 19). In this manner, castings of 15 or 16 tons weight of the type illustrated have been completed within seven to eight days from the commencement of ramming of the first part of the mould.

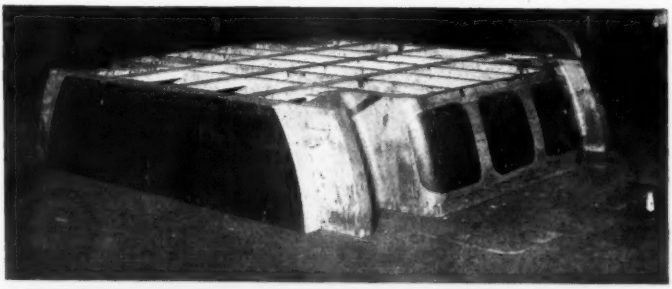
The rationalization of this heavy work called for revolutionary ideas in moulding-box construction and the cast box was abandoned in favour of fabricated moulding boxes in lightweight steel sections. Without these it would have been impossible to reach the speed of production attained.

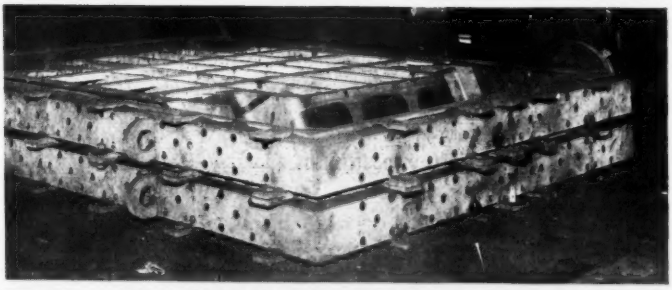
(*e*) *Large loam moulding.*

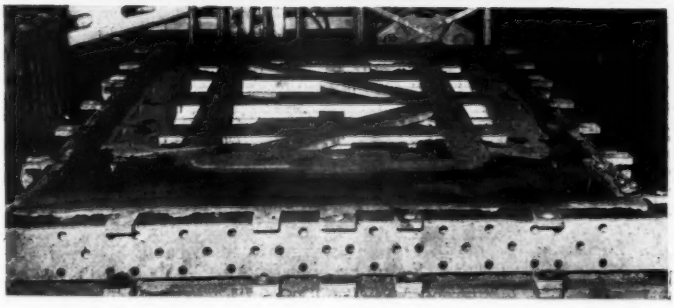
Larger work, particularly where patterns were in existence, continued to be produced in pits, but this work does not constitute more than 15 per cent. of the foundry's output.

(*To be continued*)









FIGS. 16 TO 19.—*Stages in the moulding of the turbo-alternator casing. Fig.* 16 *flat bed prepared in front of the impeller rammer and flangepiece embedded; Fig.* 17 *first "slice" of the body shape in position; Fig.* 18 *first composite box-part placed on the location pins; Fig.* 19 *ramming proceeding.*

Corrosion of Iron and Steel

Methods of protecting iron and steel against corrosion will be demonstrated to the public in the Great Hall, Battersea Polytechnic, London, from 10 a.m. to 4.30 p.m. tomorrow. Some 30 exhibits will demonstrate the most important methods and processes for the prevention of corrosion of iron and steel in five main sections:—Effect of design; treatment of the corrosive medium; cathodic protection; protective coatings, and tests and methods of testing. Although many individual firms are participating, this is not a trade exhibition, but a demonstration of protective processes. Admission is free.

Schuman Plan Criticized

An American's Reaction

"The Schuman Plan, which culminated in the setting up of the European Coal and Steel Community, was forged under pressure from the United States." A citizen of the U.S., Mr. Clarence B. Randall, makes this statement. Mr. Randall is chairman of the Inland Steel Corporation; was E.C.A. steel consultant in Paris is 1948. He is therefore not without knowledge of world steel. He has in recent years undertaken various missions abroad for the U.S. Foreign Operations Administration, and last August was elected chairman of the new Foreign Economic Policy Commission of the Republican Administration.

In his recent book, "Freedom's Faith" (Little, Brown & Company, Boston, U.S.A., $3), Mr. Randall declares his faith in the free enterprise system and considers the issues and controversies (including restrictive practices on the part of both labour and management) which are likely to affect its stability.

He is forthright in his statements of opinion on American participation in world affairs. The U.S.A. is badly prepared to lead the free world, even in the field of business, he declares. Few have travelled widely, still fewer have foreign languages to form first-hand opinions on international questions, and only a handful have friends oversea with whom they regularly exchange viewpoints. Often Americans violate abroad the principles they declare sacred at home—principles of sovereignty and self-determination. "If the truth were known, it might be found that some of the post-war upheavals in France came about because we asked for too much too soon. To what extent our pounding of the table has created similar tensions within N.A.T.O. and obstacles for the European Defence Community, only the insider would know, but the pattern may well have existed there, too."

Forged under United States Pressure

Talking specifically of European Coal and Steel affairs, Inland Steel's chairman declares that America needs to continue in Europe, just as she needed the Marshall Plan. But the reason is neither compassion nor trade; it is American security. "We are in Europe solely to serve ourselves." Both persuasion and dollars have been used to enforce conformity to the Marshall Plan for American security. "If by our pressure we had any part in causing other nations to surrender sovereignty, we have done an immoral thing, for the obvious reason that we would not surrender sovereignty ourselves

"The Schuman Plan was forged under such pressure. Whether it will have the stability of a structure put together with less haste, only history can decide. The emphasis has been upon immediacy, and there has been no studied attempt, even with revolutionary ideas, to allow time for the development of public opinion that comes from full understanding. Contemporary events in Europe confirm this viewpoint." U.S. administrators, in enforcing European approval of the Schuman Plan by their suggestion that otherwise U.S. aid might be discontinued, ignored the fate of Benelux—the first significant effort to raise co-operation among nations to the level of limited corporate unity. "For years men of the utmost goodwill in Belgium, Holland, and Luxembourg had striven manfully to tear down, one stone at a time, the walls that divided their peoples, and to create a new structure that would be functionally sound. In spite of really great efforts, carried on with high intelligence in a calm atmosphere over a substantial period of time, Benelux is still not a success."

"What will the Schuman Plan do to the social and economic structure of Europe in general, or of steel in particular? It will be tragic irony indeed if it transpires that in our zeal for European unity, we have unwittingly helped to bring about the re-establishment of cartels and the supernationalization of steel," Mr. Randall concludes.

Fewer Young People for Industry

There is at present a big demand for recruits to industry. Yet the number of young people becoming available for work has declined, and is not expected to rise until 1957. Whereas in 1939 about 715,000 boys and girls reached the statutory minimum school-leaving age, then 14, during 1952 only 650,000 reached 15, the present leaving age. The reason for this decline was the low birth rate of the 1930s, although the raising of the school-leaving age to 15 reduced by one year's age group the number of boys and girls in the employment field compared with pre-war days.

These facts are given by the National Youth Employment Council in its report on the achievements of the Ministry of Labour's Youth Employment Service, which was published on January 11 (Stationery Office, 2s.). The report says that the service is concerned with the social problems caused by the payment of unduly high wages to some young people during their early years at work. There are many examples, it states, of young people who select their early jobs solely on the basis of the immediate wages they will receive and ignore other considerations, such as the suitability of the work and the long-term prospects it offers. Because of this, some employers experience difficulty in finding suitable young people to take apprenticeships, since those usually offer relatively low wages in the early years. According to the Ministry of Labour, the industries mainly responsible for diverting the nation's youth in this way are light engineering, the motor trade, and the building industry.

The report records the view of a number of Welsh teachers who say that industry is demanding high qualifications of boys who are offered only junior positions. The teachers believe that if boys of sufficient quality are not being recruited by industry, the fault lies primarily with industry in that industrial jobs are not being made sufficiently attractive.

Scottish Light Iron Castings Industry

Annual Review by our Scottish Correspondent

The manufacture of light iron castings in Scotland —mainly centred in the Falkirk area—experienced a difficult and disappointing year in 1953. It was a year which caused grave concern to the industry, and presented the ironfounders with the problem of endeavouring to keep their men as fully employed as possible under conditions which could only be described as equivalent to a slump. The reasons for this recession in the industry were diverse and complicated. For one thing, the home market experienced a considerable falling-off in demand in the early part of the year due to the wave of panic-buying of cast-iron goods which occurred previously. As a result, merchants found that they were left with heavy stocks on their hands, and that time was required to work off the back lag.

Towards the end of the year, there were indications that the home demand was returning to normal, and that once more the foundries would be called upon to meet a steady flow of orders. Unfortunately, that was but the start of the longed-for resumption, and throughout the year the foundries had continued to experience a slackened demand for their products.

Modification in house design and housing equipment also materially affected the home demand. In particular, local housing authorities, in the interests of economy and speed in completing new houses, were compelled to reduce the number of fireplaces provided so that it became normal to have a fireplace in one bedroom instead of, say, in three. Spread over all the housing schemes in the country, such economy meant a considerable difference in the amount of castings the foundries were called upon to provide.

Retrenchment Policy

The home demand was also adversely affected by a tendency on the part of the public not to order replacements on such a substantial scale as in former years. Many people appeared to be content to struggle along with out-moded and inefficient heating and cooking equipment rather than to invest in more-modern equipment, incorporating the latest ideas in fuel efficiency and heat conservation.

In addition, the Falkirk and district foundries had to compete during the year with an intensification in competition from the manufacturers of similar articles in other materials than cast iron. Asbestos cement, for example, became increasingly used in place of cast-iron rainwater goods, while pressed-steel items were favoured by some in the manufacture of cooking equipment. Steel pressings, welded together, were also employed in the manufacture of baths.

Admittedly, these substitutes did not—and do not—compare with cast iron so far as durability and low maintenance costs are concerned, but nevertheless, they provided formidable and increasing competition. Indeed, their growing popularity will make it extremely difficult for the foundries to recapture the dominant position they once held in those markets.

Another difficulty which the industry had to face during the year was the closing of markets which had formerly absorbed a large proportion of cast-iron goods. In particular, the foundries in this area were hard hit by the Canadian and Australian import restrictions which were originally imposed for balance of payment reasons. By the beginning of the year these import restrictions were already of long standing, with the result that many valuable markets for such goods as cooking appliances and baths were closed to the Scottish founders. It is true that during the year there was a partial relaxation of some of these restrictions, but the relaxation was not sufficient to restore what had been lost.

A second complicating factor with regard to the sale of Scottish products in Commonwealth countries was the establishment of foundry units in such countries as South Africa, Australia and New Zealand, the three countries which provided the bigger part of the overseas market for Falkirk light iron castings. The existence and development of these overseas foundries is bound to have an ever-encroaching effect on the production of the parent foundries in this country, and it can only be hoped that the prestige of the Falkirk and district foundries, and the tag "Falkirk Made," will continue to exercise an appeal to a discriminating world market.

Despite all the material difficulties facing the industry during the past year, founders continued to lay stress on the need for research and for improving foundry techniques. The development of new lines on the research benches continued, and increasing importance was attached to the research and laboratory departments, on which the industry depended to keep the name of Falkirk in the forefront of light castings production.

Mechanization and Training

Steps were taken also to advance the programme of mechanization which in recent years has revolutionized foundry practice. Mechanization, except in the very smallest foundries, was, indeed, an essential introduction, for mechanical moulding was the ideal solution where it was necessary to produce a large number of similar castings economically. Mechanization has also done much to solve the problem of maintaining a sufficiently large skilled labour force to carry out the day-to-day work of the foundries.

Allied to this was the increased attention given by the major foundry groups and the industry as a whole to the training of apprentices. During the year it became increasingly recognized that under modern industrial conditions apprentices could not be fully trained, simply by setting them to work in the production departments, and accordingly more emphasis was placed on the value of the schools which were established so that new entrants to the industry could be taught the techniques of their trade.

At Burnbank Foundry Trades Centre, in which Stirlingshire Education Committee are assisted by a Joint Advisory Committee on which representatives of the employers and the operatives serve, young moulders, fitters, patternmakers and sheet-metal workers are taught their respective crafts by specialist teachers. The Centre is of too-recent origin—it was opened in May, 1952—to be credited with examination results, but the consistently high attendance figures indicate that there is a substantial interest on the part of the employers and operatives which holds out the promise of future successes. Founders feel that this policy of stimulating high standards of craftsmanship in young entrants to the industry is one that will pay dividends in the future.

So many diverse circumstances have to be taken into account that it is difficult to say what the future holds for the industry. As explained, the past year has been a difficult one, but a study of the published accounts of the principal ironfounding groups indicates that, in terms of finance, the industry has held its own. Indications are that the prospects for 1954 will be brighter, and while the industry is not expected to approach the peak production figures of two years ago.

Steel Production in 1953

Target Figure Surpassed

The British steel industry achieved in 1953 a further substantial increase in production. In every month the output of ingots and castings was above the 1952 level, and the gain over the whole 12 months was the largest recorded in any post-war year except 1948, when production rose rapidly after having been seriously affected by the fuel crisis of 1947.

The steel industry's self-appointed target for 1953 was 17,500,000 tons. Statistics issued last week by the British Iron and Steel Federation show that this figure was surpassed. Total production of steel ingots and castings last year was 17,609,000 tons—an increase of 1,190,000 tons on the total for the 53 weeks of 1952. On a comparable basis the increase on 1952 is nearly 1,500,000 tons.

Output of pig-iron in 1953 was 11,175,000 tons, as compared with 10,728,000 tons in 1952.

At one time last year an even larger steel output appeared possible, but production fell rather short of expectations in the summer and early autumn. The accompanying graph, published by courtesy of the British Iron and Steel Federation, shows the progress made, month by month, during the past three years, with annual comparisons for earlier periods.

Pig-iron and steel outputs in the last three months of 1953 are compared with corresponding 1952 totals in Table I. Steel production last December was the best ever recorded for the month, averaging 338,900 tons a week, as compared with 313,700 tons a week in December, 1952. Pig-iron output averaged 225,400 tons a week, also a record for the month, comparing with 206,300 tons a week in December, 1952.

TABLE I.—*Production of Pig-iron and Steel in the last quarter, 1953 and 1952.*

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1953.				
October	221,500	11,519,000	355,000	18,460,000
November	228,500	11,883,000	363,000	18,878,000
December	225,400	11,723,000	338,900	17,624,000
YEAR'S TOTAL ..	11,175,000		17,609,000	
1952.				
October	204,200	10,616,000	327,800	17,044,000
November	206,800	10,753,000	345,200	17,951,000
December	206,300	10,728,000	313,700	16,314,000
YEAR'S TOTAL ..	10,728,000		16,418,000	

New Capacity

The favourable outcome for 1953 was made possible by the extra capacity provided as a further stage of the industry's development programme was completed.

On the steel side, the most notable increase in capacity resulted from the completion of the melting shop at the new Lackenby plant of Dorman, Long & Company and at the Shotton plant of John Summers & Sons. These meant a gross additional capacity of over 1,000,000 tons a year, partly offset, however, by the closing of some old plant. Additional steel-melting furnaces were also brought into production at a number of other works.

On the pig-iron side, the industry had the full benefit of the six new or rebuilt blast furnaces blown in during 1952. Early in 1953, moreover, the first of the new Shotton furnaces, the largest built so far in this country, came into production, while less spectacular, but substantial extensions of capacity took place elsewhere. To keep these furnaces in full production (and to cover steelworks' requirements for oxidizing purposes) arrivals of imported ore increased from 9,600,000 tons in 1952 to 10,800,000 in 1953; at the same time, consumption of the leaner home ores was raised from 16,100,000 to 16,600,000 tons.

Pig-iron Production

Despite some loss of output due to technical difficulties, pig-iron production (all qualities) showed an increase of about 500,000 tons, to a 1953 total of 11,175,000 tons. For steelmaking qualities alone the increase was rather large, since there was a less active demand for foundry iron in 1953. The consumption of pig-iron for steelmaking rose, on a comparable basis, by about 750,000 tons, and although a smaller quantity of iron was put into stock than in the previous year, the home output still required to be supplemented by a small tonnage of imports—again rather less than in 1952.

The increase in the steelmakers' scrap consumption was only slightly smaller than the increase in their pig-iron usage. Supplies of scrap were, indeed, rather better than might have been expected. The scrap drive, in which the B.I.S.F. has co-operated with the scrap merchants, yielded a continued return in the shape of tram rails, household and farm scrap, and material from remote locations which would not normally be economic to collect. As foreseen, however, the campaign has lately been giving diminishing returns and these special measures are now to be discontinued.

TABLE II.—*Materials for Steelmaking.* (*Thousand Tons.*)

—	1952.	1953.*
Pig-iron :		
Production	8,261	8,795
Imports	689	620
Stock increase	*299*	*75*
Consumption	8,651	9,340
Scrap :		
Own arisings	4,422	4,710
Home bought	4,154	4,410
Imports	695	795
Stock increase	*202*	*210*
Consumption	9,069	9,705
Total pig-iron and scrap	17,720	19,045
STEEL PRODUCTION	16,418	17,609

* Partly estimated.

Although there was little increase in scrap receipts from inland sources, there was a sharp increase in shipbreaking scrap—a reflection of the easier shipping position. Hence, total "home bought" scrap supplies were above the 1952 level. Imports were also larger, while "own arisings" increased in line with the growth of steel production. The relevant figures are set out in Table II, in which the 1952 column covers 53 weeks.

PRODUCTIVITY SUGGESTIONS brought more than £200 to employees of Kelvin & Hughes, Limited, industrial, marine, and aeronautical instrument makers, at the company's Barkingside (Essex) factory during 1953. Of more than 100 ideas submitted, just over half received awards. Apart from special awards the average amount earned by each adopted suggestion was just under £3.

Large High-frequency Furnaces

New 12-ton Steel-melting Units at AB. Bofors, Sweden

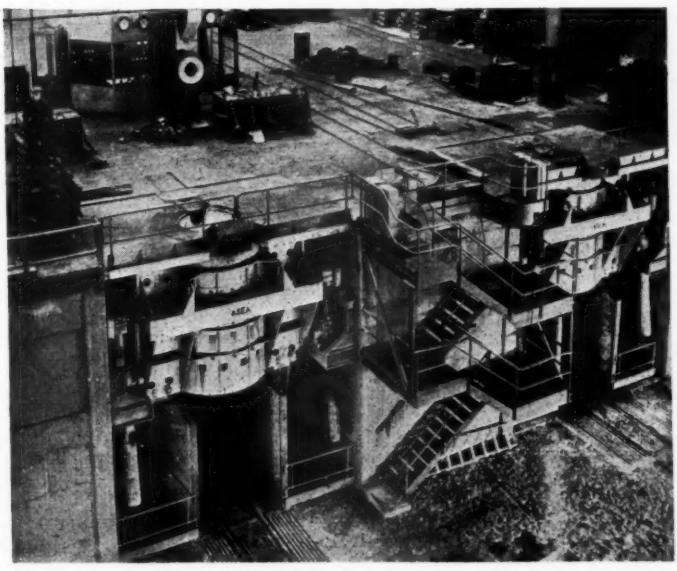
High-frequency furnaces were chosen to increase the production capacity at the AB Bofors in Sweden. These were designed to melt 12-ton charges to meet certain requirements, and they are claimed to be the largest of their type in the world.

In order to produce large ingots for forging, the capacity of the high-frequency furnaces available at the Bofors steelworks in Sweden was raised to 12 metric tons per heat, which was the maximum thought practicable by the furnace builders. It is claimed that the company now possesses the world's largest high-frequency furnaces.

The equipment, supplied entirely by the Swedish electrical firm A.S.E.A., has been in service since 1951, and the results obtained so far have been satisfactory. The essential parts of the installation are:—Two tilting furnaces or crucibles, each capable of holding a 12-ton heat; motor generator and bank of condensers; control gear; and various auxiliary machines.

The furnaces are installed in the casting shop at a height such that during charging, the upper platform, *i.e.*, the top level of the crucibles, is approximately 20 ft. above the shop floor. At the same time the platform provides storage space for the alloying metals and other materials (Fig. 1). The control cabin for the plant is situated behind the furnaces. The motor-generator, the condensers, the control apparatus and the auxiliary machinery are housed immediately below the platform level.

FIG. 1.—*General view of the high-frequency furnaces. The control cabin is at the top left.*



Furnace Construction

Each furnace is encased in welded steel, and is pivoted on a horizontal axis. The furnace bottom and crucible are supported on a masonry foundation. The copper tubular winding, which surrounds the crucible, is 1,600 mm. (about 5 ft. 3 in.) diameter, and carries cooling water. Between the turns of the winding and also on its inner surface is a highly refractory ceramic insulator. The winding is surrounded by supporting sheet laminations, which also form a magnetic yoke neutralizing the magnetic flux in the furnace housing and the other parts of the construction.

The quartz paste forming the crucible is tamped round a sheet steel pattern, in direct contact with the ceramic insulation of the winding. The steel pattern melts with the first heat and simultaneously the paste surrounding it frits together forming a strong crucible, measuring 1,300 mm. (4 ft. 3 in.) dia., and capable of holding molten metal to a depth of 1,400 mm. (4 ft. 7 in.) for a 12-ton heat.

Towards the top the crucible includes a crown of refractory bricks, in which there is a pouring lip and also a slag hole towards the rear. With a view to determining the gases which are released on melting, openings have been provided round the circumference of the crown through which these gases may be drawn off through a special exhaust system.

To build a crucible strong enough to undergo the tilting was one of the factors which limited the dimensions of the furnace. In the Bofors furnaces, the thickness of the walls of the crucible is about 150 mm. (6 in.) which allows for the thinning which accompanies every heat because of the temperature, chemical attack, local erosion, etc. A year's experience has shown that these crucibles may be used for about 100 heats.

On maximum operation the current in the winding is 18,000 amperes and operates at 600 cs. per sec. Cooling is ensured by water circulation, the

Large High-frequency Furnaces

input being approximateiy 400 litres (90 galls.) per min.

Generators and Condenser Units

The high-frequency current is supplied by a motor-generator, which comprises a 5,000 h.p. synchronous motor, 1,000 r.p.m., 8,000 volts, which drives two synchronous single-phase 1,700-kw., 600-cycle, 2,100-volt generators connected in parallel. The total output of the generators is thus 3,400 kw. The division of the output between two generators is in no way related to the principle of the system and was dictated by constructional reasons only. It would have been more difficult and more expensive to have taken this output from a single generator.

The motor-generator is started in the machine room, after which it is automatically synchronized on the line. From starting to synchronization takes about 85 sec. and during this time the motor develops about 4,000 h.p., so that it may be deduced that about 76 kwhr. must pass before normal running is established. The high-tension circuit breakers and the transformer which ensure correct starting are situated in a special operating cabin.

A large bank of condensers is connected between the generators and the furnace and is enclosed within 10 fireproof cubicles. The charge of the condensers is 10,000 kvar. (reactive kva.). The voltage control of the generator and the total or partial connection of the condenser bank is automatic. The contactors and the commutators and the system of conductor rails or bus bars are placed in part in a chamber above the bank of condensers and in part in a switch room behind the furnaces. The system of conductor rails itself contains about 17 tons of copper.

Two exhausting systems each with a throughput of 23 cub. m. per sec. (about 800 cub. ft. per sec.) are provided in order to cool the motor-generator and the bank if condensers. Fire protection for the generator and condensers is assured by an automatic release acid CO_2 extinguisher.

The installation is designed to melt a metal charge in one of the crucibles taking about 2,500 kw. and simultaneously to take about 900 kw. to hold the metal in the other crucible in the molten state. If melting only is wanted, it is possible to feed a single crucible with a power of 3,400 kw. When melting and the maintenance of the metal in the molten state are both in hand at the same time, the crucibles are connected electrically so that the crucible in which melting is occurring acts as an auto-transformer for the other. Either crucible may be used for melting, while the other is used for keeping steel molten.

Once the motor-generator has been started, in the machine room, the system is controlled by the melter in the cabin, where he can regulate the power according to requirement. An instrument board indicates to the furnace operator the performance of the various parts of the installation, such as the temperature of the bearings, etc., of the motor-generator, and the circulation of water in the furnace. The motor-generator may be stopped either from the machine room or from the control cabin.

The tilting of the furnaces is effected by an electro-hydraulic mechanism operated by levers situated on the platform near to the furnaces. It is possible to incline the furnaces to 100 deg. forward and to 75 deg. to the rear in order to run off the slag (Fig. 2).

FIG. 2.—*The slagging operation in progress on the H-F furnace.*

The high-frequency furnaces are particularly suited to the production of high-quality carbon steels, but pure raw materials with low sulphur and phosphorus contents must be used since the crucible lining does not allow the elimination of these elements. It is for this reason that apart from scrap returned from the steelworks itself, the only materials used are wood charcoal, pig-iron and sponge iron. These furnaces with acid linings are thus specially suited to Swedish steelworks, which offer the conditions most appropriate for their utilization.

These 12-ton units have also been described by the Bofors engineer, Tage Hahn, in the French journal *Mecanic*, No. 6, 1953.

NEWTON BROS. (DERBY), LIMITED, electrical engineers, of Alfreton Road, Derby, held their annual dinner at the Assembly Rooms, Derby, on January 11.

BRITISH RAILWAYS plans for new rolling stock in 1954 include the provision of 2,750 passenger train vehicles, 53,000 freight wagons, and 325 locomotives.

New Equipment

Constant Weight Feeder

The "Simon" patent weight feeder is designed to deliver a continuous flow of material at any desired rate per hour, irrespective of any alterations in the bulk density or changes in the ability of the material to flow. The machine is controlled by weight and does not suffer from the limitations of volumetric feeders; thus, if there is partial blockage at the feed inlet, the weighing unit will promptly detect the reduction in the feed rate and automatically apply the necessary correction to the feed control unit. Any change in the density or consistency of the product is taken care of on the same principle. The accuracy of these machines is of a high order, being within the region of plus or minus ½ per cent. or better.

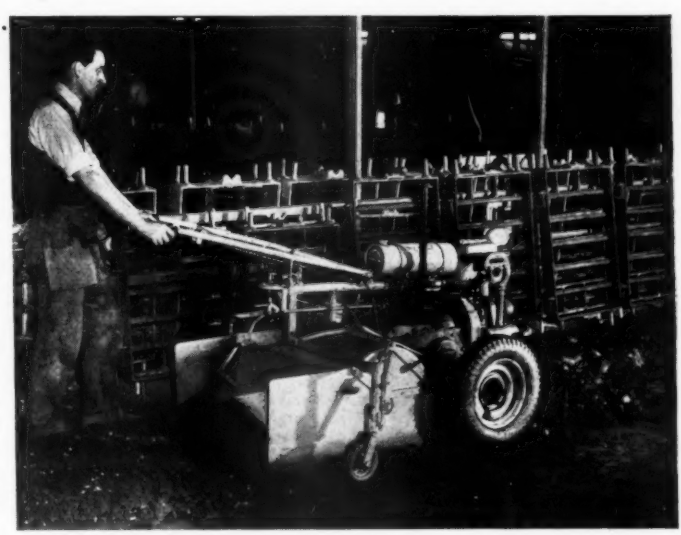
The setting of these feeders is simple, the operator merely placing calibrated weights corresponding to the desired rate of feed on the weight hook attached to the beam. Once set, the feed rate is automatically maintained, irrespective of the density changes or flow of the material.

All Simon patent constant weight feeders embody a patented feature which consists of a simple automatic two-rate correction control. Thus, when changing from one setting to another, the correction to the feed control unit is applied continuously until the feed rate is correct. The weighing unit will then apply corrections in small increments only, thus preventing the feed control unit from hunting. All machines are fitted with a cut-off switch, which disconnects the circuit to the driving motor, or operates the alarm circuit when there is no material above the feed inlet. The appliance is made by Richard Simon & Sons, Limited, Phœnix Works, Basford, Nottingham.

New Machine for Floor-sand Preparation

Even those people with but a slight interest in agriculture have heard of the Howard "Rotavator," which is manufactured by Rotary Hoes, Limited, of Horndon, Essex. Readers will be interested to learn that this has now been applied to foundry practice, where plate moulding is carried out. Experiments have been made at the works of Belling & Company, Limited, of Enfield, with the "Gem" Rotavator for turning and mixing the long lines of moulding sand in readiness for use by moulders.

The standard 30-in. model of the "Gem" has been modified for use in foundries by (1) extending the wheel centres and thus enabling the machine to straddle the line: (2) using a 3 to 1 reduction in the final drive, giving the low speed essential for easier control and for producing even pulverization and mixing; (3) the addition of two small castor wheels, fitted to either side of the machine (by adjusting these the cutting height of the blades can be varied); and (4) through the redesigning of the rear shield the steam can escape freely. The illustration shows the machine in operation at the Belling foundry.



A.B.B.F. Advisory Committee

The Association of Bronze and Brass Founders announce that the advisory committee elected to organize meetings and stimulate interest in non-ferrous foundry matters in the London area is:—Mr. W. A. Buxton (Eyre Smelting Company, Limited); Mr. A. R. French (J. Stone & Company (Charlton), Limited); Mr. A. Goddard (J. Bolding & Sons, Limited); Mr. W. T. Hobkirk (J. Hobkirk, Sons & Company, Limited); Mr. E. R. Mills (Mills Engineering Products, Limited); and Mr. W. G. Murray, Borough Polytechnic. The next meeting of non-ferrous founders interested in this project is to be held at the Clarendon Restaurant, Hammersmith, at 2.15 on March 11. It will be preceded by a luncheon of A.B.B.F. members at 1 p.m., at which non-members will be welcome. This costs 13s. 6d., excluding wines. It should be emphasized that all non-ferrous founders in the London area are free to participate in the meeting.

Patternmakers' Birmingham Meeting

It should be clearly understood in connection with the forthcoming meeting of master patternmakers to be held in Birmingham on February 3 that it is with the object of forming—if deemed desirable—an association which is quite distinct from that detailed in a circular recently widely distributed, stressing the negotiation of wages and working conditions as a primary objective. The meeting on February 3 envisages the creation of a body which will represent the trade on all matters, such as standards, proposed Government legislation, nomenclature, timber supplies, scholastic and examination boards, and so forth.

MR. A. A. F. HUNT, chief chemist and metallurgist and a member of the management committee of Tyseley Metal Works, Limited, died suddenly on January 15. He had been with the firm for close on 32 years.

Further Work on Mould Reaction

In a paper before the Institute of Metals on "The Oxidation of Aluminium/Magnesium Alloys by Steam: A Contribution to Research on Mould-reaction," by Marjorie Whitaker, B.Sc., A.I.M., with an appendix on the "Constitution of Oxide Films Formed at High Temperature on Aluminium/Magnesium/Beryllium Alloys," by A. R. Heath, B.Sc. (communication from the British Non-Ferrous Metals Research Association), the authors summarize their findings as follow:—

The work described formed part of a research on methods of preventing the reaction between aluminium/10 per cent. magnesium alloy and the steam atmosphere generated in a sand mould, a reaction causing surface oxidation and gas porosity in the casting. To reproduce conditions giving rise to this reaction, small cylinders of alloys were heated in steam in a laboratory apparatus, and the amount of reaction was assessed by the change in weight. Tests on alloys containing 0·0001-0·15 per cent. beryllium, the element usually added to inhibit mould-reaction, disclosed minimum reactivity at 0·004 per cent. beryllium, suggesting that this is the optimum addition. The rate of oxidation in the laboratory test obeyed a logarithmic law. Reducing the moisture content of the atmosphere in the apparatus by dilution with argon decreased the reaction. Investigation of the effect of impurities on the inhibiting action of beryllium showed sodium to be the only harmful one, iron, silicon, copper, calcium, potassium, and carbon being innocuous. Prior degassing of the metal with nitrogen, chlorine, and hexachlorethane, the use of melting fluxes based on chlorides of potassium and magnesium, and grain-refining additions of titanium and boron were also harmless. Small additions of cerium, niobium, tantalum, thorium, vanadium, and zirconium, selected on account of the properties of their oxides, had some inhibiting effect on the reaction, both in the presence and absence of beryllium, but it was too small to have any practical application in the foundry. From the results of electron-diffraction and electron-microscope examinations of oxide films it appeared unlikely that the protective action of beryllium could be attributed to a single-phase layer of beryllia in the film.

Mond Nickel Fellowships

The Mond Nickel Fellowships Committee now invites applications for the award of Fellowships for 1954. The main object of these is to enable selected applicants of British nationality and educated to university degree or equivalent standard to obtain additional training and wider experience in industrial establishments, at home or abroad, so that, if they are subsequently employed in executive or administrative positions in the British metallurgical industries, they will be better qualified to appreciate the technological significance of research and to apply its results.

There are no age limits, though awards will seldom be made to persons over 35 years. Each Fellowship will occupy one full working year. It is hoped to award five Fellowships each year of an approximate value of £900 to £1,200 each. Applicants will be required to define the programme of training in respect of which they are applying for an award, as well as particulars of their education, qualifications and previous career. Full particulars and forms of application can be obtained from the secretary of the Mond Nickel Fellowship Committee, 4, Grosvenor Gardens, London, S.W.1. Completed application forms will be required to reach the secretary not later than June 1, 1954.

John Wilkinson

Speaking to the Bilston Historical Society, Dr. W. H. Chaloner, of Manchester University, perhaps the greatest living authority on the Staffordshire ironmaster, John Wilkinson, categorically stated that the first iron boat was launched at Bradley, and not, as has sometimes been claimed, on the Severn, in Shropshire. Dr. Chaloner, giving an account of his researches into the life of the "father of the iron trade," said that a large amount of information had been obtained from French, German and Swedish sources. Some of the most informative, however, were in the Belgian State archives. They came from an abbey near Liège. The abbot of the time had called on John Wilkinson and his brother William to seek advice on setting up the means of producing cannon for sale to the Americans, having decided that it would be shrewd business to employ the abbey's surplus funds in the making of armaments for sale.

The Wilkinsons were a family of founders and supplied cast-iron cannon to the Government for four of the five major wars of the 18th century. When the Seven-Years war ended, they supplied cannon to the East India Company, the Sultan of Turkey, the Empress of Russia, and to the Dutch. John Wilkinson arrived in Bilston in 1756 and first concentrated on castings. He set up a forge in 1782, acquired shares in a copper mine in Cornwall, developed lead mines in North Wales, established a lead-pipe factory at Rotherhithe, and experimented with a steam threshing machine in Denbighshire.

Duplicate Conference

On the occasion of the joint British Cast Iron Research Association/Council of Ironfoundry Association conference on "Simplifying Foundry Operation," many members of those organizations who wished to send representatives had to be disappointed owing to insufficiency of accommodation. In view of its success, another conference on similar lines at which all who wish to attend can be accommodated has been arranged.

The programme of lectures given at the earlier conference will form the basis of the new programme, for which the dates of February 18 and 19 are confirmed. Ashorne Hill, near Leamington Spa, is again to be the venue.

Forms of application to attend are obtainable from Mr. G. R. Woodward, manager, intelligence department, B.C.I.R.A., Alvechurch, near Birmingham.

Non-ferrous Foundry Statistics

According to the Ministry of Supply, the production of sand-, gravity-, and pressure-die castings in aluminium-alloys during October was 1,796, 3,564, and 1,204 tons respectively, whilst that of magnesium-alloy castings was 377 tons.

The British Bureau of Nonferrous Metal Statistics state that the output of copper-base castings for the eleven months of 1953 was 45,302 tons as compared with 61,014 tons for the corresponding period of 1952. The output for November was given as 4,814 tons, a better figure but still not so good as the previous year.

THE LONDON OFFICE of Holman Bros., Limited, mining and quarrying plant specialists, etc., of Camborne (Cornwall), is moving on February 6 to 44, Brook Street, London, W.1 (telephone: HYDe Park 9444).

Control in an Investment Foundry*

By D. F. B. Tedds, F.I.M.

(*Continued from page* 42)

PROCESS CONTROL

The development section of the foundry is responsible for working out and detailing the operational sequence for each component required to be produced in the foundry. Once production of an item commences, careful records are kept by the management at all stages of the process, since, should trouble develop, it is imperative that the history of each batch of work can be traced, in order to determine whether or not there has been any deviation from standard procedure. An example of such records for the spraying section are shown in Table I. The daily records of the casting section are

TABLE I.—*Process "Time Sheet" for Primary Coating Application.*

Date.	Component No.	Serial No.	Process time.
20.11.53	*B.72402*	*539432*	*7.30 a.m. to 9.30*
,,	*B.80062*	*539436*	*9.30 to 11.45*
,,	*B.74951*	*539510*	*1.0 to 2.30*

abstracted in greater detail as shown in Table II. All necessary information is given at the head of each sheet and actual details are entered as shown in italics. From this data it is possible to trace the case history of any suspected castings. The batch number for each individual cast is taken from this chart and transferred to the casting as soon as it is removed from its mould. Included with this cast number is the furnace identification letter; a daily batch number and a yearly numeral. Thus the final batch number takes the following form C2.115.3; and from this, at some future date as required, it is possible to identify the casting as having been made in 1953, on a certain date known to correspond with batch 115, and from furnace C. From that, the daily casting chart can be located and all details unfolded.

Once the castings have been batch numbered, they are, as outlined earlier, sent to the fettling department where they are shot-blasted, feeders, runners, etc., are removed, and they are given a preliminary visual inspection. Careful records are taken of all defective castings and these are detailed on a scrap-analysis chart and passed to the management immediately for any possible action (see Table III). From such records it is possible to locate any fluctuation in the percentage rejections for any particular type of defect over a period, and thus bring into action, as outlined previously[1], means for eliminating any weaknesses which may have developed in either the equipment or manual application.

Laboratory Control

The laboratory staff are responsible for the control of all incoming raw material, chief among them being the wax used for the production of the patterns. The wax, as delivered, is checked by the tests given in the Appendix of this Paper. Apart from the control of incoming raw material, laboratory personnel are also responsible for controlling, at regular intervals, the various refractory mixtures and solutions used during the process, by either sieve analysis, density or viscosity measurements. Coupled with this is routine chemical analysis, *e.g.*, every melt receives a check on the carbon content, since the possibility of carbon pick-up is ever present when using carbon-arc furnaces for steel melting. Also under laboratory control is the X-ray and chalk test examination of all castings and their consequent record systems.

Batch Control

The issuing and controlling of each batch of work commenced in the foundry is the responsibility of the production control office. The primary considerations governing the time at which it is desirable to issue instructions for work to be put on to the shop floor are: (1) The date at which the particular component is required, and (2) the time cycle between commencement of work and final completion. Before a new component is commenced in the foundry, a work request slip is passed to the

* Paper presented to the East Midlands branch of the Institute of British Foundrymen.

[1] *Proc.* Inst. Brit. Foundrymen 1952, vol. XLV.

TABLE II.—*Precision Foundry Casting Data Sheet.*

Batch No. *205* Serial No. *573416* Quantity *20* Title *Stator Segments.*
Date *20.11.53* Part No. *B.80258* Good Moulds to Cast *20* Material *BACE.220*
Mould Identification Letters *MJ* Casting temp., *1,580-1,600 deg. C.* Air Pressure, *10 lb. per sq. in.*

Foundry identification.	Flux or additions.	Metal temperature, deg. C.	Air pressure. lb. per sq. in.	Number of components in mould.	Cast N. shift or D. shift.	Remarks.	Observer's signature.
A1.	*CaSi + Al*	*1,580*	*10*	*1*	*D*		
A2.	,,	*1,600*	*11*	*1*	*D*		
A3.	,,	*1,580*	*8*	*1*	*D*	*Leaky Joint Face.*	

TABLE III.—*Precision Foundry Castings—Scrap Analysis Chart.*

BATCH NO. *200* No. Cast. *120* ITEM: *Compressor Blades* DATE CAST *16.11.53* DATE TO STORE..... No. to store.....

Part No.	Furn. No.	Mat. Spec'n.	1st inspection		Analysis of rejections.									No. sat.	To fett.	2nd insp'tn.		X-ray.		Mat. acc.	H/T H/TST	Chalk test.		Final insp'tn.	
			Acc.	Rej.	A	B	C	D	E	F	G	H	XS			Acc.	Rej.	Acc.	Rej.			Acc.	Rej.	Acc.	Rej.
B.76402		*230*	*110*	*10*																					
	A1												*2*												
	B2							*2*	*1*																
	B3										*2*														
	C3						*2*						*1*												

(*Space for ten more entries*)

(A) Carb. mould
(B) Shrinkage, visual.
(C) Cold shut and mis-run
(D) Oxide.
(E) Sand incl.
(F) Poor surface
(G) Damage
(H) Air holes.
(XS) Slag.

ratefixing and process department, where a process is evolved. This information, together with the request slip, is then passed to the Card Issue Department where the constant master is typed and the necessary paper work issued. A serial number is allocated to each batch of components required, and the batch is henceforth identified by this number.

The necessary paper work for each batch includes the following:—

(*a*) *A batch label* (Table IV) which accompanies the batch from issue until receipt of the completed batch in finished-part stores.

(*b*) *Material requisition* to cover issue of material.

(*c*) *Control slips* (Table V)—one for each operation.

(*d*) *Clock cards* are also issued for each successive operation.

(*e*) *Batch-completed ticket* (Table VI), for use when the batch is completed.

The clock cards are pre-slotted in bulk with the main order number and batch serial number to facilitate in final cost-office sorting. As soon as the foundry control office receives the batch of cards, a sighting card (Table VII) is initiated on which are entered all details regarding part number, serial number and operational sequence. On this card is recorded the progress of the batch of work with

TABLE IV.—*Batch Label.*

	M.O. No. *21100*	Serial No. *548144*	Date. *28.10.53*	Quantity Regd. *40*	Drawing No. *B 47876/7*
See control slips for details of operations.	Description of Part. *Produce casting for half clamp.*		Material Spec. and Description. *BACE.176.*		Total Material.
1st off must be viewed.	Special tests and instructions.				
View after each operation.	Material Batch No. Qty.				

Batch	Qty. Passed	Inspector's Stamp	Date	Store	Date	Qty. Received.	F.G. Receipt Note.	Signature
Completed								
Uncompleted								

TABLE V.—*Control Slip.*

M.O. No. *21100*	Serial No. *548144*	Date. *28.10.53*	Quantity Required. *40*	Drawing No. *B 47876/7*
Description of Part. *Produce casting for half clamp.*		Material Spec. and Description. *BACE.176*		Total Material.

Op. No. *2*	Operation Description. *Inject wax to make pattern* (1 *die*)	Machine or Section. *Wax injector* 1/1–1/4	Setting Time. *Wax room*	Time Allowed each *15 m. SS.*

Qty. Received.	Qty. Passed.	Qty. Scrapped.	Code.	Waster Note No.	Remarks.	Date.	Inspector's Stamp

TABLE VI.—*Completed Batch Ticket.*

M.O. No. *21100*	Serial No. *548144*	Date. *28.10.53*	Quantity Regd. *40*	Drawing No. *B 47876/7*
Description of Part. *Produce casting for half clamp.*		Material Spec. and Description. *BACE.175*		Total Material.
Qty. Made.	Qty. Scrapped.	Date.	Signature.	Remarks.

BATCH COMPLETED AT.....

details of scrap, etc., from issue to final view. By reference to the main schedule of requirements, the controller decides when to issue the particular batch of work, bearing in mind the time cycle of the component and the relative urgency of other batches of work. It is usual to keep approximately one week's work in the shops at a time, the issue of work being controlled: (*a*) To prevent underloading and overloading of plant, and (*b*) to ensure that the correct work is being done at the correct time.

By keeping a minimum of work on the shop floor, the controller is certain that the work required for programme purposes is being done. If a surplus of work be issued, discrimination by the operator between favoured and disfavoured work (from a bonus-earning point of view) would result, and urgent requirements would be held up in favour, perhaps, of those less urgent. Each section of the foundry is equipped with a "work available rack," into which the control slip is "posted" as it is received from the shop control.

The management systematically selects from this rack the control slip for the next job and the timekeeper selects the corresponding clock card and punches it. The operator's name is then stamped on both cards and on completion of the job he is "clocked off." As the successive operations are completed, the control slips are entered by the inspectors with details of good and rejected components and returned to the control office. The succeeding control slip is then issued. The controller enters in the respective sighting card the quantity "good" and quantity "rejected," and also enters on the clock card the quantity on which bonus is to be paid, *i.e.*, the quantity "good."

Completion of the Batch

The control slip for the last operation is "final view" and the inspector marks the control slip and the batch label with the quantity passed. This is passed to the controller, while the batch of work and batch label are delivered to finished-part stores. From the batch label, the batch-completed label is made out and passed to main production control office for recording purposes, whilst the batch label with details of scrapped components is passed to the costing department. From the clock cards, the cost office staff can calculate the worker's bonus and also show the true cost of producing a given batch of work. This latter information is of considerable value in comparing the estimated cost with the actual batch cost.

Conclusion

No mention has been made of the considerable control exercised by dimensional inspection checking which is conducted on all investment castings, but from the foregoing it is obvious that the investment-casting technique is a highly technical process, requiring, as stated earlier, a high degree of supervision and control. It is only by such control that successful quantity production is possible. In conclusion, the Author wishes to thank the directors of the Bristol Aeroplane Company Limited for permission to publish this Paper.

APPENDIX

Routine Tests Carried out on Wax Samples

(1) *Setting Point.* This test is carried out in a glass U-tube 1.0 cm. dia. 2.0 cm. radius to bend. As the melting point of waxes may be some 10 deg. C. higher than the setting point and practical knowledge of the temperature of setting in moulds, etc., is more important than the liquefying temperature, a method of measuring setting points similar to the setting of waxes in practice is used. The glass U-tube is half filled with molten wax and immersed in a water-bath at 10 deg. C. above the expected setting point. The whole is allowed to cool steadily free from draughts. At each degree fall in temperature a slight pressure (2 in. water) is applied slowly on one limb of the U-tube, sufficient to shift the wax level by 1.0 cm. The temperature of the bath at which no further movement can be caused by applying pressure is taken as the setting point.

(2) *Volume Contraction.* This figure is taken as the total contraction of the wax in all directions in cooling from 5 deg. C. above its setting point (given above) to average room temperature (20 deg. C.) and is of practical use in assessing changes in size of wax castings in cooling after injection. The method used is to assemble a dilatometer consisting of a small glass flask and capillary tube of known size, the tube length being calibrated. 10 gm. of molten wax is cooled in a 25-ml. flask until solid and the flask is filled with clean mercury on top. The capillary tube, having a U-bend at one end carrying a bung, is forced into the neck of the flask and wired on. When inverted and immersed in a water-bath the whole acts as a dilatometer and the level of the mercury will rise if the imprisoned wax expands and will sink on contraction. The water-bath is heated to about 10 deg. C. above the setting point and as the bath cools to room temperature, the height of the mercury in the capillary is plotted. The total apparent contraction volume on 10 gm. on cooling from 5 deg. C. above setting point to 20 deg. is thus obtained. The dilatometer is dismantled and the weight of mercury is obtained. From this, the expansion due to the mercury is calculated and sub-

DESCRIPTION :—*Blades.* TABLE VII.—*Control Office "Sighting" Card.* TIME CYCLE :—

BATTERY NUMBERS			Wax runner.	Inject	Date.	Runner.	Spray.	Wax pots.	Mould.	Sent to Ballard.	Remove pot from mould.	Cast.	Break mould.	Shot blast.	Cut runner.	Visual inspect.	Matl sample.
		Op. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ser.	*529653*	Date Req.															
Qty.	*120*	Cont. SL. Iss.		*14/8*	*17/8*	*17/8*	*17/8*	*19/8*	*20/8*	*20/8*	*20/8*	*21/8*	*27/8*	*27/8*	*28/8*	*30/8*	*1/9*
Date	*16.7.53*	Good	*10*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*117*	
Date Iss.		Scrap	—	*99*	—	—	—	—	—	—	—	—	—	—	—	*3*	
21100		Date	*17/8*	*17/8*	*17/8*	*17/8*	*19/8*	*20/8*	*20/8*	*20/8*	*21/8*	*27/8*	*27/8*	*28/8*	*30/8*	*9/9*	

(Headings on L.H.S. are repeated to accommodate several batches of entries on one sheet.)

tracted from the apparent value. The results are expressed in volume per weight of wax, per cent., as this is the simplest method of determination. There is a break in the density curve in all waxes from the molten state to about 8 deg. C. below setting point, and this makes direct volume calculation very complicated.

(3) *Strength.* As a practical check on the strength of fairly-thin wax sections a 10 by 2.0 by ½-cm. bar is cast in a card form or mould and allowed to cool overnight (or at least four hours). It is loaded at the centre point and supported 1.0 cm. from each end and the weight required to break the bar is determined. (The load is applied on a 1.0 cm. flat stirrup at the centre.) The type of break is usually clean, but some waxes are semi-plastic and deform badly at the breaking point.

(4) *Ash on ignition.* As a check on deleterious substances in the wax, the percentage ash content will reveal sand particles or the presence of rust, etc. The sample with the least amount of ash will be the most satisfactory under all conditions.

DISCUSSION

MR. H. P. MILLAR said he was impressed by the statement that only 50 to 60 per cent. of the wax was recoverable. It seemed to someone not initiated in the investment process to be rather a low rate of efficiency for the salvage of one of the main raw materials. Perhaps there was some very good reason for this. Another point he noticed on one control chart in casting the same component there was recorded a variation of almost 25 per cent. in air pressure. He wonderd whether it was so critical that the difference between 8 and 12 lb. made any difference in the finished product and asked what affect air pressure had on cold shuts and so forth. Again, what was the particular benefit derived from having nylon-mesh screens. Finally, he said it seemed that the business of actually producing the article was the smallest part of it, as there appeared to be a tremendous amount of "paper" work. With the economics of the job in mind he asked how investment casting compared with the shell-moulding method of producing the same type of casting.

MR. TEDDS said that 50 to 60 per cent. salvaged wax was probably an understatement. Some was lost through soaking into the mould itself and a certain amount due to spillage. Wax was expensive, but as they were able to reclaim a good proportion they were satisfied, and the amount reclaimed was sufficient for requirements. They had tried to incorporate wax reclamation in their machines but without success. As to air pressure, if the job required 10 lb. he did not like it to be reduced. The desirable air pressure would vary with the type of component—thin-section blades would require 10 lb., whilst for a casting with a larger cross-section, one could reduce the pressure. It was, however, not critical to a pound. Referring to screens, the Author said he had tried phosphor-bronze gauze, but this required replacing every week. With the use of nylon or silk, the increased cost was more than compensated due to their longer life. The question of the amount of "paper" work was related to the complexity of the process. Unless one had the control detailed, it only needed one small thing to go wrong and scrap castings resulted. Such control was really necessary.

As to economics *vis à vis* with shell moulding, the latter process was being developed, but mainly for the making of single blades. Obviously one could not make all types of castings by this method. It was possible that, eventually, the B.A.C., investment foundry would be split into two parts, one half on lost-wax moulding and the other on shell moulding. It should, however, be borne in mind that the shell method had to compete with the high-grade surface finish obtainable by the lost-wax process.

Pertinent Points

MR. J. ROXBURGH said that when considering this Paper one should realize that the investment process was a very specialized one, and for that reason one had to exercise very-high-quality control. With reference to the inspection of castings, Mr. Roxburgh said he was rather surprised to hear Mr. Tedds say that the hot-oil-and-chalk process was better than X-ray examination. It was realized that hot-oil-and-chalk was ideal for discovering superficial defects, but X-ray examination was necessary

TABLE VII.—*Continued.*

F.B. Number :—*B.72427*

Ex. c/c test.	Dress	Fettle.	Heat treatment.	Shot-blast.	Straighten	Chalk test.	X-ray	Final view.								Scrap	TO STORES.	
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
	2/9	*3/9*	*10/9*	*11/9*	*15/9*	*24/9*	*24/9*	*28/9*										
116	*116*	*86*	*116*	*116*	*116*	*113*	*113*	*106*										
1	—	—	—	—	—	*3*	—	*7*								*14*	*106*	*29/9*
2/9	*3/9*	*10/9*	*11/9*	*15/9*	*24/9*	*24/9*	*28/9*	*29/9*										

for finding internal defects. He wondered whether on steel castings, they had been able to differentiate between a hot-tear and a crack, or whether they did not have to bother about such aspects. Control of the air pressure was obviously essential in order to eliminate the question of cold laps, etc., but could Mr. Tedds say if this air pressure had an affect on the soundness of the casting or the shrinkage which might occur. He noticed that the Author had not made any detailed reference to the material which he called "slurry," which was used as an investment material for the wax pattern and he also had dismissed the metal side merely by saying it was "steel." Mr. Roxburgh said he himself was very interested in quality control and production control, and he wondered if Mr. Tedds would say whether by recording of all the scrap, the analysis of the scrap, the reason for the scrap, etc., and by taking action as a result of perusal of those particulars, he had been able to reduce scrap considerably.

The Author had referred to the question of shell moulding, and Mr. Roxburgh said it was generally known what people claimed regarding accuracy. Could he say how accurate were the limits to which he had to work.

MR. TEDDS, confirming that the hot-oil-and-chalk test would only pick up surface defects, said with reference to hot-tears, that they encountered many defects and amongst them were hot-tears which could not be identified by X-ray examination, but the hot-oil-and-chalk method would not differentiate between a hot-tear and a cold shut. X-rays were always used to find internal defects. He was not convinced that the air pressure applied to the top of a feeder helped soundness. The feeders were sometimes about 2 in. away from the actual casting. Pressure did not appear to help and tapered feeding had to be used owing to the variation in section. The investment composition used consisted of ordinary Portland cement, reclaimed material and St. Austel clay. The metal chosen was invariably one of the high-alloy steels; that containing 12 per cent. Cr was one which was found a little difficult to cast but this gave a good surface finish if the moulds were cooled prior to pouring. Coming to scrap analysis and control, Mr. Tedds said it was necessary to have this control and to act straightaway on the information collected, as any delay obviously resulted in a quantity of scrap. Once production had started, should anything go wrong, one could still run into considerable trouble and although there were many control sheets they had been found both beneficial and economical.

The Author said that blades made by the lost-wax process were cast within a 0.005 in., and the same with shell moulding. At the moment, on the shell process the two half shells were being bolted together, as otherwise they tended to spring open.

MR. GOSS said that he did not quite follow what was happening when the furnace was rotated and the mould removed. How was the metal retained with the furnace in an inverted position? Were the small arc furnaces, in fact, holding furnaces containing just sufficient metal for one mould and fed from a central melting station? The use of the hot-oil-and-chalk method of locating surface defects would, he thought, be ideal on the smooth surface of an investment casting but it would be difficult to remove the chalk on the rougher surface of a normal sand casting?

MR. TEDDS replied that the furnaces were electric-arc units having a single pouring hole. The exact weight required for a given casting or spray of castings was charged into the furnace, and each time the furnace was completely emptied when casting. Records were kept of each particular mould with the weight of the metal and its specification, and the storekeeper weighed out the correct material for each individual item. Hot-oil-and-chalk testing could be used on normal sand castings and was in fact so used throughout the works on all light-alloy castings.

"Paper Work"

MR. STONE asked what percentage of the personnel was required to attend to the "paper work." With regard to the 15-lb. furnace, he wondered whether they ever managed to make a casting weighing 15 lb. and whether any trouble was experienced with handling the larger type of mould. The cycle of the firing stove was given as five or six hours. ——what was the hourly rate of casting from one of the furnaces described?

MR. TEDDS said the personnel responsible for the "paper work" represented 4 per cent. of the total. From a 15-lb. furnace castings from 14 to 14½ lb. could be cast quite successfully. The heaviest casting made, with runners and feeders removed, was 4-5 lb., and the standard size of the mould was 9 in dia. (they were doing some 11 in. dia.), 12 in. to 14 in. high. An overhead monorail was used for handling all moulds and no great difficulty was experienced. The melting rate from each furnace was such that every 20 to 30 min. there was a cast, depending on size of mould, weight of metal melted, etc.

MR. ASTON asked what was the "life" of the pots, and also when and how Mr. Tedds made calcium silicide and aluminium additions. He also asked what was the permeability of the actual mould.

MR. TEDDS said the life of the furnace was one week, which in terms of actual heats amounted to about 200. Calcium silicide and aluminium additions were only made to the Nimonic type of alloy. These additions were made at late as possible. A small pill of calcium silicide wrapped in aluminium foil, together with the aluminium was dropped into the furnace as the mould was being taken from the oven. He did not know the actual figure for mould permeability, but it was obviously quite low and some trouble was experienced in this direction from time to time.

Alternative Coating and Melting Methods

MR. SHORT asked whether Mr. Tedds had done any melting using a high-frequency furnace, and had he had any experience of the radiomatic pyrometer instead of the immersion type. In addition to the oil-and-chalk method his own inspection department used ferric chloride.

MR. TEDDS said they had not done any H.-F. melting with the lost-wax process, but when they took up the shell-moulding process they found great variation in carbon content and they were coming to the conclusion that with the shell process they would have to introduce induction melting and discard the arc furnace. Experience in using a radiomatic pyrometer, proved it to be unsuitable when melting the Nimonic type of alloys and those which melted with an oxide layer.

MR. EDWARDS said the Author had mentioned that, after the wax assembly stage, some patterns were dipped and some sprayed. Did either of these two methods show any advantage over the other?

MR. TEDDS replied that for a long time they only sprayed patterns and they had found the coating was very close to the wax and gave a better surface finish. However, there were a number of jobs which it was difficult to spray, due to "blind" spots, and for these jobs the dipping operation was used and they were sprayed afterwards. With the combination of dipping and spraying good results were achieved.

MR. LAMB asked whether when spraying or dipping they had any trouble from the coating being uneven. Regarding the refractory core, he took it that this was pushed into the wax pattern before it was invested, but how did this affect the coating operation?

MR. TEDDS said that the core was made separately; an alumina mixture was used for that, and they were able to make the cores rapidly. They took the wax pattern and pushed the core in after it was assembled, the primary coating being applied afterwards, without any undue complications. With the dipping operation, the coating tended to fall away especially from sharp edges, which was another point in favour of spraying last.

B.I.S.R.A. Staff Changes

Formerly head of the steelmaking division of the British Iron and Steel Research Association, DR. A. H. LECKIE has taken up the position of technical officer with the Iron and Steel Board. DR. J. PEARSON is temporarily taking over the duties of head of the steelmaking division, in addition to his present duties as head of the chemistry department.

Dr. Leckie studied chemistry at University College, London, spending some years on research on the Raman effect in molecular spectroscopy. In 1937 he joined the technical department of the British Iron and Steel Federation (Iron and Steel Industrial Research Council) and was engaged on research and plant design with special reference to the study of thermal and aerodynamic conditions on open-hearth furnaces. When B.I.S.R.A. took over the work of the council, Dr. Leckie was appointed to the staff of the steelmaking division, becoming deputy head of the division, and succeeding Dr. Myers as head in 1948.

After graduating in 1933 at the University of London with first-class honours in chemistry, Dr. Pearson obtained his M.Sc. in 1934. In that year he joined the research department of Tube Investments, Limited, to carry out work in connection with the manufacture of steel tubes and allied products. From 1937 to 1946 he was employed in the explosives branch of the Armament Research Department, Ministry of Supply, and obtained his doctorate in 1946 for research work on the polarography of organic compounds. In 1946 he became head of the chemistry section of B.I.S.R.A's Swansea laboratories, where he was largely concerned with problems on the disposal of spent pickle liquor. He was appointed head of the chemistry department in 1950.

B.I.S.R.A. has also announced the retirement under age limit of MR. D. LUTHER PHILLIPS from his position as head of the South Wales laboratories on February 10. He will, however, remain with the association in a consultative capacity. He will be succeeded by MR. S. S. CARLISLE, who is at present head of the instruments section of the physics department. Mr. Carlisle has been closely associated with the industry's co-operative work on instrumentation, particularly that of open-hearth furnaces. He is a member of the council of the Society of Instrument Technology.

A NEW PRIVATE COMPANY, English Steel Export Corporation, Limited, has been registered with a capital of £50,000 in £1 shares. The company intends to carry on the business of general exporters and merchants, manufacturers, forgers, iron and steel finishers, etc.

AN AUSTRALIAN BRANCH of British Insulated Callender's Cables, Limited, has been opened in south Melbourne, and will be operated by British Insulated Callender's Cables (Australia), Pty. According to Sir Alexander Roger, chairman of the parent company, the branch will tender for some of the work on the Snowy Mountains development undertaking.

Personal

MR. T. H. MILLER who has been a departmental director of Shaw, Darby and Company since 1942, has now been appointed a full director.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED announce the appointment of MR. T. W. J. TEMPLE to the managership of their Middlesbrough office.

MR. CYRIL ROBERTS has retired after 43 years with Ruston & Hornsby, Limited, for the last nine of which he was assistant secretary to the company. He received a presentation from his colleagues.

MR. F. R. MARTIN has relinquished his position with W. & T. Avery, Limited, of Birmingham, to join Allied Ironfounders, Limited, as assistant to the managing director of their works at Burton-on-Trent.

MR. WILLIAM JARDINE, secretary of Sharp & Company (Lennox Foundry), Limited, Alexandria, a subsidiary of Drysdale & Company, Limited, engineers, Glasgow, has been presented with a gold wrist watch on his completion of 50 year's service at Lennox Foundry.

CAPT. L. J. SARJEANT, of Ilkley, at one time general manager of the Thornbury works, Bradford, of the English Electric Company, Limited, and later a director of the English Electric Export and Trading Company, has been adopted as Conservative candidate for the by-election on February 6 in the Ben Rhydding Ward to fill a vacancy on Ilkley Council.

THOMAS KAVENY, JR., managing director, Herman Pneumatic Machine Company, Pittsburgh, Pa., has been elected by the American Foundrymen's Society Board of directors to serve the unexpired term of Victor F. Stine, of the Pangborn Corporation. Mr. Stine resigned his directorship because of the pressure of business commitments. Mr. Kaveny took office as from December 2, 1953.

A new member of the staff of the National Foundry College is MR. W. B. HENDRY, who has been assistant foundry manager in the iron foundry of Smith, Patterson, Limited, Blaydon-on-Tyne. Mr. Hendry graduated from the University of Durham, and after service in the navy was employed in the foundry of C. A. Parsons & Company, Limited, Heaton-on-Tyne. Subsequently he attended the National Foundry College in the 1949-50 session.

OWING to advancing years, Mr. R. T. ANKERS, has resigned his position as joint managing director of Tilghman's Patent Sand Blast Company, Limited, and director of George Richards & Company, Limited, as from December 31, 1953. Mr. Ankers has been associated with the Tilghman company for the past fifty-two years and at the express wish of the company he will continue his association in a consultative capacity.

PERIODS of long service with Hopkinsons, Limited, founders and manufacturers of safety boiler mountings and valves, of Huddersfield, are by no means uncommon, but the total of 125 years achieved by two generations of the Beaumont family is outstanding. MR. J. BEAUMONT has just retired from his position as representative of the firm in the north and west Lancashire areas, although his services are being retained in an advisory capacity until later in the year. Mr. Beaumont has completed nearly 62 years' service with Hopkinsons, thus almost equalling the achievement of his father, who also represented the firm and remained with it for 63 years. Mr. Beaumont is succeeded as representative in north and west Lancashire by MR. G. STEVENSON.

Obituary

MR. H. V. MEACHEM, assistant regional controller of the Ministry of Labour, has died at Shrewsbury aged 59. He joined the Ministry in 1913 and was well known throughout the Midlands for his services in various offices. In 1950, he was appointed regional industrial relations officer and later, assistant regional controller for the West Midlands Area.

MR. JAMES WILSON WHITEHOUSE, SENIOR, of Tettenhall, died on January 6 at the age of 87. In 1908 he was founder with his sons of the metal refiners and smelters business at Willenhall known for some time as the Metal Products Company (Willenhall), Limited, and now associated with the family business as the Willenhall Metal Reclamation Company, Limited.

MR. ARCHIBALD BLAIR, one of the founders of the Clydebank firm of Aitchison Blair, Limited, specialists in the construction of marine engines and in ship and engine repairs for half a century, died on January 11, at the age of 84. With the late Mr. John W. Aitchison, he started the business in 1904 after training as an engineer and spending a period at sea, during which time he became a chief engineer.

The death has occurred of MR. WALTER E. QUINE, who was formerly naval architect and chief designer of the Quasi-Arc Company, Limited, Bilston (Staffs). He was with the company for 21 years until 1939. In the last war he was appointed principal welding overseer, under the Warship Production Superintendent, North-western Area. Mr. Quine was actively associated in the design and construction of the first all-welded ocean-going cargo vessel Fullagar, which was built in 1920.

MR. ARCHIBALD CAMPBELL HOLMS, who died on January 8 at the age of 92, served his apprenticeship with Barclay, Curle & Company, Limited, Whiteinch, Glasgow. After experience in various shipyards, mostly on the Clyde, he joined Lloyd's Register of Shipping in 1890, and in 1909 was made a principal surveyor, at the time when his book "Practical Shipbuilding" was published. In 1917 he was appointed principal surveyor in charge of the Liverpool office. He retired in 1924.

THE DEATH OCCURRED on January 13 at Cleveland, Ohio, of Mr. Charles Burgess, the technical director of the Gray Iron Founders' Society. He was the author of several high-grade pamphlets which sought to popularize the use of grey iron through the dissemination of reliable technical data. One dealing with surface finishes was the best of its type. He recently visited this country, investigating the British approach to co-operative research, and spent considerable time at Alvechurch. His passing will be deeply mourned on both sides of the Atlantic.

MR. H. R. BACKHOUSE, chairman and managing director of Mellor, Bromley & Company, Limited, textile machinery manufacturers, of Leicester, and member companies of the Mellor, Bromley group, including Pegson, Limited, manufacturers of road and quarry plant, industrial screening equipment, crushers, etc., of Coalville (Leics), died recently at the age of 59. Mr. Backhouse was apprenticed at the age of 15 to an engineer in Birmingham, and later joined the Birmingham Small Arms Company, Limited, where his promotion was rapid. In 1928 he took up the appointment of works manager with Mellor, Bromley & Company, Limited, and in 1934 was made a director. On the death in 1951 of Mr. T. C. Bromley, the founder of the firm, Mr. Backhouse succeeded him as chairman and managing director.

News in Brief

NORTHERN ALUMINIUM COMPANY, LIMITED, announce that the telephone number of their Leeds area sales office is now Leeds 33621.

CRAVEN BROTHERS (MANCHESTER), LIMITED, are exporting to Canada a 42-ft. vertical boring and turning mill which weighs about 650 tons.

MONSANTO CHEMICALS, LIMITED, announce that a new wholly-owned subsidiary, Monsanto Plastics, Limited, has been formed for the purpose of consolidating and extending the company's activities in the plastics field.

MEETINGS of the management committee and four technical sections of the *Bureau International de la Récupération* are expected to attract large attendances in the Hotel Metropole, Brussels, on January 28 and 29.

A NEW BLAST FURNACE blown in at Westfalenhütte, Dortmund, last month, has a hearth diameter of 8.5 m. (27.88 ft.), and according to "Handelsblatt," Düsseldorf, is the largest in Europe. It cost £2,550,000.

WALTER W. COLTMAN & COMPANY, a new company which will carry on the business of metal founders, engineers, and boiler makers, of Loughborough, will be a subsidiary of the well-known firm of Walter Coltman & Company, Limited, Loughborough.

GERMAN STEEL OUTPUT last year is reported to have declined to 15,400,000 tons from the previous year's total of 15,800,000 tons. Output in December is returned at 1,235,000 tons, compared with 1,258,000 tons in November and 1,335,000 tons in December, 1952.

THE CORONATION CURFEW BELL for St. Bride's Church, Fleet Street, London, has been cast at the bell foundry of John Taylor & Company, Loughborough. This bell is cast from metal taken from the 18th century ring, and bears an inscription copied from the old bells.

IT IS ANNOUNCED that Butterley Hall, near Ripley, is to be taken over by the head office staff of the Butterley Company, Limited, Ripley, when the necessary alterations have been completed. At a later date other sections of the office staff will be transferred to the Hall.

THE DIRECTORS of Aeroplane & Motor Aluminium Castings, Limited, Birmingham, have announced that the offer made by Associated Engineering Holdings, Limited, to purchase the whole of the issued 4s. ordinary shares at 20s. has been accepted by the holders of over 98 per cent. of the shares.

BRITISH FOUNDRY UNITS, LIMITED, Retort Works, Chesterfield, announce that owing to ill-health MR. R. G. WILLIAMS, their area manager and representative in South Wales and the West of England, has resigned, and MR. J. E. THOMAS, of Abertillery, Mon, has been appointed in his stead.

MR. B. A. ROBINSON, M.I.E.E., M.I.MECH.E., who has been with the Cambridge Instrument Company, Limited, for 41 years, and has been their district representative for 32 years in the Newcastle-on-Tyne area, has now retired. He is succeeded as district representative by his son, MR. W. E. ROBINSON.

FOLLSAIN-WYCLIFFE FOUNDRIES, LIMITED, announce the appointment of the following technical representatives:—Scotland: Mr. W. Macfarlane, 134, St. Vincent Street, Glasgow, C.2 (telephone: Central 6440); Northern Ireland and Eire: Mr. J. Luke, 17, Adelaide Street, Belfast (telephone: Belfast 20040).

AN INDUSTRIAL DEVELOPMENT CERTIFICATE has been issued to Spear & Jackson, Limited, Sheffield, in respect of an area of 17,200 sq. ft.. The provision of this new workshop will enable concentration of work, reduction in handling and transport, and improved layout which will lead to worthwhile increase in productivity.

ORDERS to the value of over £1,000,000 will ensure full employment for the staff of Priest Furnaces, Limited, Middlesbrough, for two years. Contracts include the provision of furnace and mill equipment for British iron and steel works, and overseas work in Normandy, Jamaica, the United States, South Africa, and Pakistan.

THE 1954 OUTPUT of the Sydvaranger iron-ore mines in Norway is reported to be almost entirely sold already, mainly to Western Germany and some to the United Kingdom and Belgium. Prices obtained are rather lower than in 1953, when the total value of iron-ore exports was approximately £3,500,000. This year's output is expected to reach 800,000 tons.

Two Welsh sheet-aluminium rolling mills have been bought by Hawker Siddeley Group. They are the Wern Works at Briton Ferry and the Byass Works at Port Talbot, both specializing in light alloys and both formerly owned by Richard Thomas & Baldwins, Limited. They will be operated for Hawker Siddeley Group by High Duty Alloys, one of the Group's subsidiaries.

THE ORDER-BOOKS of the Anti-Attrition Metal Company, Limited, Maidenhead, are described by the chairman, Mr. S. P. Loosen, as very healthy, and the Board looks forward with every confidence. The fall in the company's announced manufacturing profit from £109,318 to £79,087 is due to fewer working days, more holiday pay, the fall in metal prices, and severe price competition.

THE CITATION among the New Year Honours of a B.E.M. for Mr. W. H. Smalley, Grimsby moulder, recalls that as propeller moulder at Harper Phillips & Company, Limited, Albion Foundry & Engineering Works, Grimsby, he has over 42 years of service and helped to make over 4,000 propellers. The award is a fitting tribute for devotion to duty at the end of the company's golden jubilee year.

IT IS REPORTED that the British Wool Marketing Board has reached agreement with Jowett Cars, Limited, Bradford, for the purchase of Oak Mills, Clayton, Bradford, which have been used by the car firm for the manufacture of units for assembly at their Yule works, Bradford. The Board hope to be able to move in before the end of the year and vacate their present premises at Cumberland Works, Bradford.

UNDER an agreement signed in Delhi recently between India and the United States, $25,500,000 (about £9,107,000) will be made available to India to buy steel. India will contribute Rs. 16,000,000 (about £1,200,000). With this joint fund India, it is stated, will buy 200,000 tons of steel on a world tender for her economic development. India's own contribution will pay for handling the steel at the port of entry and other distribution costs.

THE DIRECTORS of W. & J. Chatwin, Limited, one of the Birmid Industries associates, are to present a fully-equipped tool set to Ted Loveridge, the 16-year-old apprentice mechanic who drove 18 lorries out of danger when fire broke out in the garage premises of the company on Boxing Day. Because he is too young to hold a driving licence, Ted, whose home is near the garage, had to obtain police permission before moving the lorries.

(*Continued on page* 85)

NEW METHODS

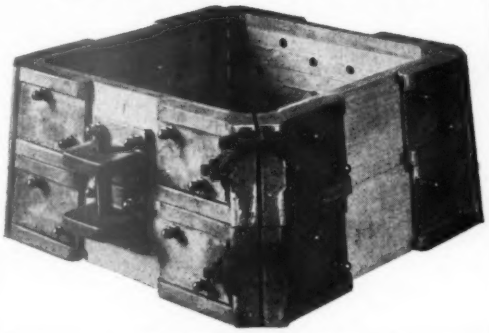
For

OLD

Available at last!

A BRITISH MADE

TAPERED SLIP-FLASK



PATENT APPLIED FOR

- IT can be altered in size at will.
- IT leaves the sand smoothly thanks to a 4° taper from top to bottom working in conjuction with a spring device enclosed in opposing corners.
- IT can be stored flat on a shelf in your stores, thus releasing much valuable space, and, at the same time it is protected from the weather.
- IT is as strong as a steel moulding box and of about the same weight size for size.
- IT does the work of twenty or thirty moulding boxes of similar size.
- IT is less than half the price of any similar Flask.

W. J. HOOKER LTD.

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TELEPHONE . . HAMPSTEAD 2495

THE TIN

that never was

At Ebbw Vale and at Trostre the new continuous mills roll out their strip; strip for the tins that never were tin, but steel.

Over twenty million boxes of tinplate were produced in 1953. A million tons of tin!

In this, and in every branch of the steel industry, production is surging forward, and the sights set on new targets. Thanks to the efforts of managements and workers alike, for eighteen months continuously, record steel output has been achieved. Britain is getting the steel she needs.

STEEL is doing a good job

THE BRITISH IRON AND STEEL FEDERATION T.67

News in Brief

(*Continued from page* 84)

DESCRIBING the improvement in Italy's trade position, the Birmingham Chamber of Commerce Journal says that Italy has almost completely ceased buying American coal, primarily because she has developed the production of natural gas on an enormous scale. So great has this development been, that it is reported that the whole of Italian industry is being revolutionized, with factories replacing electric supply with natural gas for power.

A NEW COMPANY is to be formed in the "600" group of companies whose function will be to provide a technical advisory service able to develop and advance powder metallurgy in the U.K. The company will be known as George Cohen Sinteel, Limited. The company's composition is, in effect, an alliance of the existing powder-metals division of the group, with the American Electro Metal Corporation, Inc., and Metallwerk Plansee G.m.b.H., of Reutte.

MR. C. NEWTON, director, and MR. C. ASHTON, general manager of Hepburn Conveyor Company, Limited, have just returned from a business trip to Germany, their object being to conclude negotiations regarding supplies to German foundries of equipment in which they specialize. Not only were they successful in obtaining the contracts in which they were interested, but the reception given to them by other German foundries leads to the hope that further business will develop.

A TOTAL of 9,097,661 tons of coal and coke was shipped from the Tyne in 1953, a decrease of 153,710 tons compared with 1952. Export cargoes improved by 179,889 to 2,015,254 tons, but coastwise shipments fell by 333,599 tons to 7,082,407 tons. Iron-ore imports into the Tyne last year totalled 763,728 tons, an increase of 64,608 tons compared with 1952, and exceeding the previous highest figure of 726,548 tons in 1913. It is estimated that when the new iron-ore discharging plant comes into full operation at Tyne Dock, the river's ore imports will be about 1,000,000 tons a year.

IN A STATEMENT with the accounts for the year ended September 26, 1953, of the Westinghouse Brake & Signal Company, Limited, Mr. A. R. S. Nutting, chairman, says that the current year should prove to be satisfactory in every way, provided there is no dislocation of, or interference with, productive efforts, or no increase in cost to curtail purchases of the company's products. Group trading profits of 1952-53 rose to £1,270,132, compared with £1,183,732 in the previous year, after providing £204,534 (£173,556) for depreciation and £29,822 (£25,353) for directors' emoluments and pensions.

THE BRITISH OXYGEN COMPANY, LIMITED, Bridgewater House, Cleveland Row, St. James', London, S.W.1, announce the placing on the market of the "Bantam" cutting machine. It is used for straight-line and circle cutting and is claimed to be the lightest of its type, weighing only 22¾ lb. including the cutter. With it an operator can cut mild-steel up to 2 in. thick and when used in conjunction with the radius bar, circles of between 3 in. and 45 in. diameter. For bevelled edges, the cutting head is adjustable, so enabling an inclined cut to be made at any angle up to 45 deg. The cutter is also adjustable for lateral movement and height.

IT WAS REPORTED last week that the British Iron and Steel Corporation has concluded an agreement with the U.S.S.R. for the purchase of Russian pig-iron for shipment over the next six months. It is understood that the quantity involves more than 100,000 tons of basic steelmaking iron, low in phosphorus content. It is further understood that the price paid compares favourably with U.K. domestic prices. The first shipments are now on the way, and it is likely that about 10,000 tons will have arrived by the end of January. The pig-iron is coming in Russian vessels from the Black Sea area and will be delivered at various U.K. ports.

CHANGES of considerable importance to the British iron and steel industry may follow experimental work in a pilot continuous casting plant for steel now being erected at the Sheffield works of William Jessop and Sons Limited. The plant forms part of a project of the British Iron and Steel Research Association, embodying results of research carried out in their physics department. It is hoped to achieve by this method of casting, which is akin to those already in use for cast iron and, particularly for light alloys, a product nearer the finished state than is now possible, and one needing little further rolling. Special tool steels will be dealt with, and it has been suggested that stainless steels may also be produced.

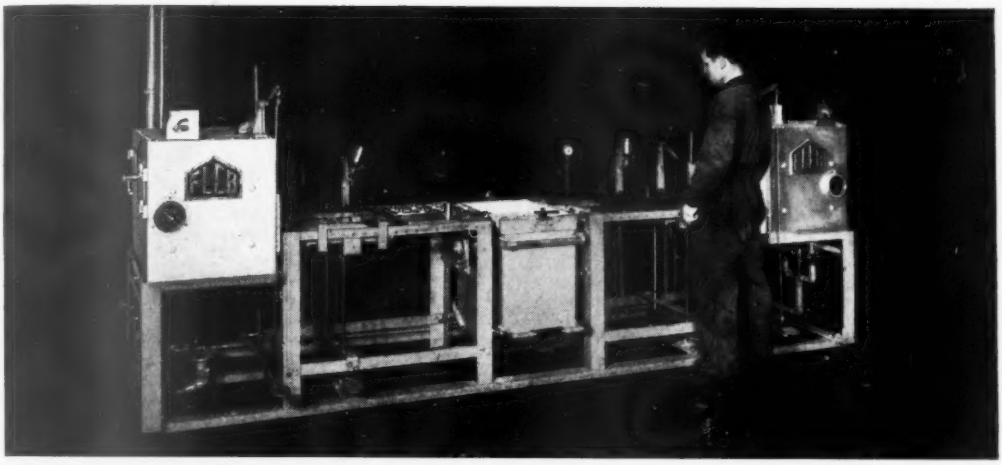
IN ORDER to join the board of F. H. Lloyd and Company Limited, Wednesbury, in the newly-established post of production director, Mr. Michael Lloyd is leaving the Weldless Steel Tube Company of Wednesfield, of which he has been general manager. The Weldless Steel Tube Company, now part of the Tube Investments combine, was founded in 1872 by the same F. H. Lloyd who founded the Wednesbury steel casting firm. In 1908 the Lloyds bought the Reliance Tube Company at Wednesfield and in 1921 moved the Weldless Steel Tube Company from Birmingham to amalgamate with the Reliance Tube in the Wednesfield premises. Mr. Michael Lloyd's departure breaks the Lloyd family connection with the Weldless Steel Tube Company which has existed since 1872.

LEY'S FOUNDRIES & ENGINEERING, LIMITED, announce an equity final of 5 per cent., as last year, to make 11 per cent. (the same), and group trading profits slightly lower at £907,974 (£927,674) are published for 1952-53. With investment income and tax certificate interest of £19,148 (£17,316), the total profit to September 30 is £927,122, against £945,000. The directors state that the production by Ley's Malleable Castings Company, Limited, of "Black Heart" and "Lepaz" malleable castings has been maintained at a high level, although there was a fall in the general demand for castings for a short period in the early part of 1953. There was, however, a substantial increase in the price of pig-iron during the year, which, together with other increased costs, caused a reduction in the margin of profits.

THE AMALGAMATED UNION OF FOUNDRY WORKERS has fined 150 moulders in three Bonnybridge foundries £2 each because they refused to take part in the nation-wide strike called by the Confederation of Shipbuilding & Engineering Unions on December 2. This was disclosed on January 7 by the Bonnybridge secretary of the Union, Mr. David Anderson. The men have been fined on direct instructions from the union's headquarters in Manchester. No time-limit has been mentioned for payment of the fines. None of the fines had been paid so far and no protest against the union's decision had been made although the men have the right to appeal. The moulders claim that they played their part in the drive for higher wages when they came out on a one-day token strike, called by the Falkirk branch of the Union on November 19. Mr. Anderson said: "The men violated union rules and must pay the penalty."

At Last!

Simple, Efficient & Low cost SHELL MOULDING with the Shelmolda



STUDY THESE POINTS

- **The Shelmolda Senior costs less than £700.**
- Size of plate 24″ x 16″.
- No complicated controls.
- Moulding always under the operator's control.
- Absolute simplicity—nothing to go wrong.
- Proved by working in a foundry continuously for months.
- Delivery 8—10 weeks.
- **The Shelmolda Junior costs less than £400.**

The Shelmolda brings this modern process within the reach of the smallest foundry. The standard machine illustrated here produces shells 23″ x 15″ but other sizes can be built to requirements. We shall be pleased to arrange for you to see the Shelmolda working in our foundry.

"Shelmolda"—Originated and manufactured solely by

FAIRBAIRN LAWSON COMBE BARBOUR LTD

LEEDS ENGLAND

236/53

Raw Material Markets

Iron and Steel

For some time past it has been evident that pig-iron production is not keeping pace with the expanding needs of the steel plants. No more blast furnaces are immediately available for operation, and recourse has been had to imported pig-iron. Now it is announced that the British Iron and Steel Corporation has purchased 100,000 tons of Russian pig-iron for shipment over the next six months.

Home production is fully absorbed. Steelworks' demand is seemingly insatiable. The call for common foundry iron is on a better scale, but requirements in respect of high-phosphorus iron are more easily satisfied than those for iron of low phosphorus content, while shortages of hematite are by no means infrequent.

The steady decline in the arrivals of semi-finished steel from European ports is only the anticipated sequel to the expansion of UK steel production. But imports of 1,719,510 tons of iron and steel last year refute the idea that the country has reached a state of self-sufficiency in this respect. Mainly because of the depression in the re-rolling industry, billet requirements can be readily supplied from home sources, but there is still an active demand for both British and foreign sheets, bars and slabs.

The South Durham Steel & Iron Company's plate mill at West Hartlepool, which was started in 1947, attained last week a total output of 1,000,000 tons. Under extreme pressure the weekly output has been further increased and it is claimed that with supplementary tonnages from the Continent the requirements of the shipbuilders have now been overtaken. The increased wagon and carriage building programme of British Railways also depends upon the provision of ampler tonnages of steel, and the sheetmakers are already in possession of such substantial orders that they can regard the outlook for the first half of the year with complete equanimity. The export trade is still quiet.

Non-ferrous Metals

Last week was a somewhat disastrous one for holders of non-ferrous metals, tin being the only metal in which a serious setback did not occur. In fact, tin was able to score an advance, for cash closed £2 10s. up and three months £2 better. Unquestionably, the prospect that some scheme for controlling production will eventually come into force is operating to hold the tin market up in the face of evidence that demand for commodities generally is tending towards a lower level. In the other three metals there was, however, something like a slump in values, which brought them at the close down to a level not seen for some time past. Copper, for example, gave way badly, much of the £12 drop in cash coming last Friday when, in the afternoon, there were sellers at £220, the three months' price being £211, a loss of £11. Zinc was weak, losing £3 15s. for January and £2 5s. for April, one good feature being the reduction in the backwardation to 15s., the lowest seen for a few weeks. But lead did even better, for before the week ended the backwardation of 30s. had given place to a contango of 10s. and at the end this had narrowed to 5s. Since no reductions in the main selling prices of the US producers were seen last week, this acute uneasiness on the London market was rather inexplicable, even though quotations on the New York commodity exchange gave way to a marked extent.

Consumers are, of course, very much disturbed over last week's events, and prices of brass and copper semis have been reduced in line with the fall in the raw materials. Confidence has been somewhat dashed; although it has been fashionable for some time to talk copper down, nobody seems to be particularly pleased when the fall takes place. Much now depends on what happens in the United States. Since 30 cents is equal to £240 it can be seen that London at £222 is a long way below New York in copper. After a fall such as we saw last week, some sort of rally is to be expected if only because of profit-taking by bears. Scrap prices must obviously fall now that new metal values have been reduced so drastically, but what the new levels will be has yet to be seen.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* January 14, £226 to £227; January 15, £221 to £222; January 18, £215 to £216; January 19, £219 to £220; January 20, £219 to £220.

Three Months: January 14, £218 5s. to £218 15s.; January 15, £214 15s. to £215; January 18, £206 to £207; January 19, £208 to £209; January 20, £209 to £209 10s.

TIN, Standard—*Cash:* January 14, £660 to £662 10s.; January 15, £660 to £662 10s.; January 18, £645 to £647 10s.; January 19, £652 10s. to £655; January 20, £665 to £667.

Three Months: January 14, £631 to £632 10s.; January 15, £634 to £635; January 18, £620 to £622 10s.; January 19, £623 to £625; January 20, £635 to £637 10s.

ZINC—*January:* January 14, £73 5s. to £73 15s.; January 15, £71 10s. to £72; January 18, £69 10s. to £70; January 19, £70 to £70 5s.; January 20, £71 5s. to £71 10s.

April: January 14, £72 to £72 5s.; January 15, £70 15s. to £71 5s.; January 18, £68 10s. to £68 15s.; January 19, £69 5s. to £69 10s.; January 20, £70 5s. to £70 10s.

LEAD—*January:* January 14, £88 to £88 2s. 6d.; January 15, £85 15s. to £86; January 18, £82 15s. to £83; January 19, £81 10s. to £82; January 20, £81 15s. to £82.

April: January 14, £87 15s. to £88; January 15, £86 5s. to £86 10s.; January 18, £83 5s. to £83 10s.; January 19, £82 5s. to £82 10s.; January 20, £82 to £82 5s.

National Foundry Craft Training Centre

Foundry proprietors are again reminded that there are vacancies for students at the National Foundry Craft Training Centre, West Bromwich. Term No. 54 (a second-course term) ends on February 26, and term No. 55 begins on March 8. The latter is a third-course term. The next first course term (No. 56) being on April 5.

The duration of each course is a month, the full syllabus being spread over approximately three-and-a-half years. The direct cost to founders sending apprentices is not large, and the enthusiastic commendation of the boys who have undergone this "extra-mural" instruction, leaves no doubt that the temporary absence of the apprentice from his "home" foundry is more than compensated for by the additional knowledge, both practical and theoretical, that he acquires.

Full particulars of the syllabus, fees and conditions of entry may be obtained from the hon secretary of the Centre, Mr. R. Forbes Baird, 117, Church Lane, Handsworth Wood, Birmingham, 20.